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Director for Program Analysis and Evaluation
The Joint Warfare System Office

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Joint Warfare System Test and Evaluation Plan

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JWARS/TEST AND EVALUATION PLAN/VER 1.0/03 DEC 98

TEST AND EVALUATION PLAN FOR THE JOINT WARFARE SYSTEM

Program Element — 0208052J

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1-19-99
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Approved, subject to the inclusion of OPTEC's comments provided in memorandum, dated 14 Apr 99.

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5/20/99
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CSTE-OEC-IMA 14 Apr 99

MEMORANDUM FOR RECORD

SUBJECT: OPTEC Changes to the JWARS Test and Evaluation Plan

1. The JWARS Test and Evaluation Plan (TEP) was signed by the Commanding General, Operation Test and Evaluation Command, that included changes to be made to the next revision of the TEP. The changes reflect clarification to specific operational test and evaluation terminology. The changes include the following:

a. Change paragraph 4.1 k., page 4-4 from:
The OTAs will require separate and direct coordination for providing operational test data for use in JWARS simulation;
To: The Director, JWARS, will acquire weapon system operational test data from the OTAs for incorporation into the JWARS simulation database. The Director will be required to separately and directly coordinate with the OTAs to obtain their weapon system operational test data.

b. Change paragraph 4.3.2.b., page 4-8 from:
Assess how well JWARS provides users with a balanced warfare representation to include C4, ISR, and logistics and supports the Planning and Execution and Force Assessment.
To: Assess JWARS balanced warfare representation as defined by Joint Staff, CINCs, and other users and based on military judgement to support Planning and Execution and Force Assessment.

c. Change paragraph 4.3.2.b, page 4-8, from:
Assess the adequacy and availability of data to support modeling of friendly and enemy forces to include the use of operational test data to refine results.
To: Assess JWARS database as defined by the Joint Staff, CINCs, and other users to support modeling of friendly and enemy forces.

d. Add the following to paragraph 4.3.2.c, Page 4-9, Line 21:

"Prior to the start of the LUT for Release Two, the PM representative of the T&E WIPT will organize a panel of user experts to develop the definition of Balanced Representation. The panel will meet at the direction of the chair to prepare the definition and provide to the OTAs prior to the start of the LUT. At the end of the LUT, the OST will survey users to obtain data for an assessment of JWARS' capabilities to represent a balanced force within the functionality to be delivered to the users in Release Two."

JUN-21-1999 09:37 FROM OPTEC(IMAED) TO 996969563 P.01

SUBJECT: OPTEC Changes to the JWARS TEP

e. Change paragraph 4.3.3.b., page 4-10 from:

Assess the capability of JWARS to provide users with a balanced warfare representation to include C4, ISR, and logistics and supports the Planning and Execution application, Force Assessment application, System Effectiveness and Trade-off Analyses, and Concept and Doctrine Development.

To: Assess JWARS balanced warfare representation as defined by Joint Staff, CINCs, and other users to support the Planning and Execution application, Force Assessment application, System Effectiveness and Trade-off analyses, and Concept and Doctrine Development.

f. Change paragraph 4.3.3.b, page 4-10, from:

Assess the adequacy and availability of data to support modeling of friendly and enemy forces to include the use of operational test data to refine results.

To: Assess JWARS database as defined by the Joint Staff, CINCs, and other users to support modeling of friendly and enemy forces.

g. Add the following to paragraph 4.3.3.c, Page 4-11, Line 14:

"Prior to the start of the LUT for Release Two, the PM representative of the T&E WIPT will organize a panel of user experts to develop the definition of Balanced Representation. The panel will meet at the direction of the chair to prepare the definition and provide to the OTAs prior to the start of the LUT. At the end of the LUT, the OST will survey users to obtain data for an assessment of JWARS' capabilities to represent a balanced force within the functionality to be delivered to the users in Release Three."

2. POC this action is LTC Claudia J. Fischer at (703) 681-6105.

LLOYD J. PICKERING
Director
Information Mission Area
Evaluation Directorate

TOTAL P.01

JUN-21-1999 10:58 681 3694 96% P.01

TEST AND EVALUATION PLAN FOR THE JOINT WARFARE SYSTEM

WIPT COORDINATION

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DOT&E (Dr. Dave Sparrow) CONCUR / NONCONCUR DATE 10/26

JDS (Mr. K. Doefer) CONCUR / NONCONCUR DATE 10/9/98

PA&E (SAC) (Mr. Matt Szczepanek) CONCUR / NONCONCUR DATE 9/29/98

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SECURITY DAA REP (JWARS) CONCUR / NONCONCUR DATE 9/28/98

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MCOTEA (Maj Jim Wedge) CONCUR / NONCONCUR DATE 3 DEC 98

_____ **CONCUR** / NONCONCUR DATE 7 Dec 98
OPTEC (LTC Claudia Fischer)

Defer to N81 Without Prejudice CONCUR / NONCONCUR DATE 4 Dec 98
OPTEVFOR (Mr. Steve Whitehead)

CONTENTS

FIGURES

TABLES

1. SYSTEM DESCRIPTION

1.1 Design Description

The Joint Warfare System (JWARS**)** is designed to be a state-of-the-art, constructive simulation that provides a multi-sided and balanced representation of joint theater warfare. The model must represent joint functions, processes and component warfare operations. It must be solidly based in joint doctrine. The model must be capable of representing future warfare and be an aid in concept development, force structure analysis, acquisition assessments, and course of action analyses. The results from JWARS simulations will be used in joint analysis for planning and programming, modernization assessments, and military operational assessments[1]. Key application areas include planning and execution and force assessment applications, system effectiveness and trade-off analyses, and concept and doctrine development and assessment. JWARS will support analysis with output data provided electronically or as printed material in either tabular or graphical form.

The end-users of JWARS include analysts in the analysis organizations of the Office of the Secretary of Defense (OSD), Joint Staff, Services, Commanders-in-Chief (CINCs), Joint Task Force (JTF) Commanders/Staff, selected other Department of Defense (DoD) organizations, and industry. JWARS will provide campaign analysts with a significantly enhanced ability to realistically model both current and future warfare.

JWARS will assist implementation of Joint Vision 2010 (JV-2010) by providing a vehicle to assess current and future military capabilities within the four emerging operational concepts: dominant maneuver, precision engagement, focused logistics, and full dimensional protection. (See: Annex G, Glossary, for definitions of these terms).

JWARS is being designed to replace the following legacy models and simulations: Tactical Warfare Model (TACWAR), the Model for Inter-theater Deployment by Air and Sea (MIDAS), the Army's Concepts Evaluation Model (CEM), THUNDER (the Air Force's campaign level model), the Integrated Theater Evaluation Model (ITEM), and the Scenario Unrestricted Mobility Model for Intra-theater Simulation (SUMMITS). Furthermore, JWARS design is intended to correct shortcomings identified in the February 1995 Secretary of Defense review of legacy combat simulations. That review noted that existing simulations are insufficient to meet the current and projected joint warfare analysis needs of DoD. Major areas requiring better representation for current and future studies of theater warfare include: balanced joint operations; the synergy across the functional warfare areas including C4 (command, control, communications,

[1] "military operational assessments" refer to the ability to use JWARS to do realistic campaign analysis at the theater or operational level of war.

and computers), ISR (intelligence, surveillance, and reconnaissance), and logistics; and appropriate representation of current and future US, allied, coalition, and threat capabilities. Existing technical and design shortcomings include model architectures, credibility of algorithms and data values, and traceability of results as well as a lack of standardized tools to automate the archiving, cross-checking, manipulation, retrieval, and transfer of data elements.

1.2 System Threat Assessment

JWARS is an analytical support system. Since it is not a combat system, a system-specific, Defense Intelligence Agency (DIA)-validated threat does not apply. However, as a DoD computer program, an automated data processing (ADP) security threat exists from unauthorized intrusion, insertion of viruses, and theft or manipulation of data contained in its files.

1.3 Measures of Effectiveness, Suitability, and Survivability

The measures of effectiveness, suitability, and survivability (paragraphs 1.3.1 through 1.3.3, respectively) will address the performance capabilities and characteristics called for in the *JWARS Operational Requirements Document (ORD),* dated 27 August 1998[2]. The ORD defines three releases of JWARS. JWARS Release 1 is the Limited Initial Operational Capability (IOC), Release 2 is the Full IOC, and Release 3 is the Full Operational Capability (FOC). The JWARS requirements in the "Capabilities Required" section of the ORD are divided between those to be achieved at Release 1, Release 2 and Release 3.

Requirements at Release 1:

- ✓ allow an analyst to identify the cause-and-effect relationships needed to explain an analysis
- ✓ provide a means to track the sources of data values; allow a global comparison of input data sets indicating, when queried, which values are changed from certified input data to excursion values
- ✓ verify and validate the objects and algorithms that represent doctrine, system and unit performance, and the environment in accordance with the V&V plan; maintain balance in the equitable representation of joint warfare functions consistent with their impact on theater warfare operations, within the context of the functionality described at Appendix C
- ✓ include C4, ISR, logistics capabilities and essential functionality that exists in current MIDAS and TACWAR models

[2] The Alpha test conducted on Release 0.5 will have very little, if any, ORD-derived test criteria.

- ✓ be capable of replacing the use of TACWAR to support the Force Assessment application, described in Appendix A of the ORD, with the warfare functionality described in Appendix C of the ORD
- ✓ develop to a single level of resolution, balanced across all warfare functions
- ✓ execute a 100-day MTW campaign faster than a 1000:1 speed (approximately 2.5 hours) for force assessment applications
- ✓ ensure execution code is not modified by simulation data
- ✓ prevent scratch files from remaining on system drives after a simulation run is completed
- ✓ complete 98% of simulation runs successfully after initiation when there are no accompanying operator input errors
- ✓ provide preprocessor functions of type checking, range checking, and context checking, along with the capability to identify the source of and facilitate the correction of errors
- ✓ create a trace or log file to aid in error diagnostics
- ✓ achieve the same output on the same hardware given the same initial conditions
- ✓ enable an analyst with ORD-defined qualifications to attain an initial productivity level with two weeks of training, and a full capability with an additional six months of sustained, in-house hands-on experience
- ✓ enable an experienced software engineer/programmer to modify the code or create software entities after five days of formal training
- ✓ provide automated decision-making features for tactical decisions
- ✓ require no modification of data sets and less than 2% change to the total number of lines of executable code to establish JWARS on a different supported hardware platform
- ✓ be capable of supporting analysis at both the SECRET (collateral) level and at higher levels of classification
- ✓ ensure model design and implementation does not preclude replacement of classified data, object, and algorithms with unclassified data, objects, or algorithms
- ✓ enable the user to interrupt the simulation, modify data, and start excursions from the same point; users shall be able to dictate rolling checkpoints that allow periodic capture of “state of the system” at user-defined intervals or events and permit restart, with data modifications, at any of these points
- ✓ be capable of being moved from a CINC’s primary site to one or more alternate sites with minimal logistical support and without any degradation in capability
- ✓ be supported on at least one platform that meets shipboard deployability requirements; and be supported on at least one platform that does not exceed two-man lift
- ✓ comply with the Joint Technical Architecture applicable to constructive analytical simulations, with the DoD High Level Architecture (HLA) for Simulations, with the Defense Information Infrastructure (DII) Common Operating Environment (COE), and be Year 2000 (Y2K) compliant

- ✓ enable users to choose from single value, common probability distributions, or user-provided distribution for input data
- ✓ facilitate examination of distributions and correlations associated with simulation results through post-processing tools

Additional Requirements at Release 2:

- ✓ provide balanced warfare representation to include C4, ISR and logistics and be capable of supporting the Planning and Execution and Force Assessment applications as described in Appendix A of the ORD
- ✓ be capable of replacing TACWAR and MIDAS by demonstrating the warfare functionality identified in Appendix C of the ORD

Additional Requirements at Release 3:

- ✓ be capable of supporting the following applications defined in Appendix A of the ORD: Planning and Execution, Force Assessment, System Effectiveness and Trade-off analysis, and Concept and Doctrine Development
- ✓ provide the user a selection of Low-to-High levels of resolution, balanced across all warfare functions; identify invalid user-selected combinations of resolution
- ✓ be capable of replacing legacy campaign models CEM, THUNDER, ITEM, and SUMMITS

- ✓ execute a 100-day MTW campaign faster than a 500:1 speed (approximately 5 hours) for System Effectiveness and Trade-off Analysis and Concept and Doctrine Development applications
- ✓ execute a 100-day MTW campaign faster than a 1000:1 speed (approximately 2.5 hours) for Planning and Execution and Force Assessment applications

1.3.1 Effectiveness

JWARS system effectiveness will be measured in terms of JWARS performance. The Joint Warfare Refinement Group (JWARG), composed of over 30 military campaign analysis experts representing organizations performing such analysis, defined the functionality needed in the initial releases of JWARS as documented in the JWARS ORD. The ORD serves as the requirements-baseline for implementation by the Configuration Control Board (CCB). System effectiveness measures to address and assess JWARS performance will be developed by the Operational Test Agencies (OTAs) in collaboration with the JWARS Test and Evaluation (T&E) / Verification And Validation (V&V) Working Integrated Product Team (WIPT). The system effectiveness measures will be based upon criteria for output products and defined conditions that are consistent with the ORD. The conditions for making measurements during testing will include representative sampling of conditions anticipated in real analytical operations.

User subject matter experts (SMEs) will assist in assessing the system effectiveness measures.

JWARS simulation functions will undergo testing by the development contractor and verification and validation (V&V) by the designated V&V agent. V&V will be followed by integration and field testing to ensure JWARS users can obtain outputs supporting end-user analysts as required at their work sites. During operational testing, JWARS must perform its simulation functions as required for accuracy, timeliness, and usefulness. For testers, accuracy includes data validity, data integrity, and algorithm correctness. Timeliness refers to data currency and response time acceptability. Usefulness will be addressed by performance measurements focused upon output identified by the end-users as the highest priorities. Usefulness will also be measured by human-system-integration (HSI) surveys and interviews, and observations by HSI subject-matter experts and military campaign analysis experts.

The analysis of JWARS system effectiveness will consider system performance of JWARS capabilities delivered with each release. The analysis will address the following: the adequacy of the database management system; the achievement of interoperability requirements as specified in the JWARS ORD; the relationship of JWARS to joint analysis business practices (i.e., the methods and procedures employed by JWARS to support user-unique approaches to the preparation and execution of simulations); and regression testing. Regression testing as used here refers to tests conducted at each development release (or iteration) that retest previously tested areas. Analysis of effectiveness will also examine the degree of satisfaction for each criterion associated with the critical operational issues (COI) 1 and 2 (see Annex E) and pertinent additional issues (AI).

The functions that are used to produce essential output are called Critical Mission Functions (CMFs). (See Annex G, Glossary for definition of CMFs). The CMFs will be identified by the WIPT in collaboration with the CCB, with consideration of hierarchical task analysis, the plans of and results from the V&V assessment, and data processing paths. The threshold of effectiveness will be defined in terms of CMF measures of effectiveness (MOEs) and/or measures of performance (MOPs) compared to the expected standard for a percent of successfully completed simulation runs. CMF MOEs will be calculated as the number of CMF successes to the number of CMF attempts for the conditions of each major end-user category, major organizational partition, external system with which JWARS must inter-operate, and essential output forms within a single analysis area.

1.3.2 Suitability

Suitability will be measured in terms of HSI, reliability and maintainability (R&M), network/system management (NSM), infrastructure, integrated logistics support (ILS),

and standards. The suitability measures will be designed to detect both JWARS problems for correction and for opportunities to improve JWARS. The focus of these measures is to ensure that users can operate and maintain the system as required. The threshold for suitability is that no suitability problem degrades JWARS performance so that the system fails to achieve the expected threshold of effectiveness (see paragraph 1.3.1). The intent of the suitability measurement is to help the JWARS Office prioritize future development actions to minimize suitability problems.

HSI measurements will examine the adequacy of JWARS features in the areas of usability, usefulness, training, documentation, and help. These concerns will be addressed for JWARS end-users, administrators who must sustain the availability of JWARS (and the data required by JWARS) to those end-users, and decision-makers who will use the analysis that JWARS helps produce. HSI analysis will extend to personnel safety, and health hazards. R&M measures will be designed to detect trends to prioritize system and procedure improvements that may be required. The analysis of reliability will be concerned with the degree to which JWARS performs its functions properly for the major end-user categories at their work locations when they require it to do so. NSM measures will concern the adequacy of procedures and processes for administrators to control and upkeep JWARS for its end-users. Infrastructure measures will address how well required hardware, software, communications, and facility items, provided by agencies other than the JWARS Office, will support JWARS operationally. ILS measures will cover fielding and sustainment concerns, such as the site survey process, maintenance, help desk, and post-deployment software support.

Standards measures will address progress toward stated operating requirements. The JWARS Office in collaboration with J8/SAMD will address Configuration Management (CM) to ensure that deployed JWARS increments meet the CM requirements for those increments. (CM is a process of managing software modifications to prevent and exclude unauthorized source code changes in order to maintain the integrity of the system. All software changes must be made in accordance with established CM procedures).

1.3.3 Survivability

Survivability will be measured in terms of how well JWARS satisfies the requirements for its security accreditation. JWARS will comply with DoD Directive (DoDD) 5200.28 and its accompanying standard, thereby helping to ensure the compliance with the Computer Security Act of 1987. Accordingly, JWARS, its associated infrastructure, and the user community should provide proactive protection against improper access, sabotage, unauthorized data modification, and viruses. Furthermore, physical security

in accordance with DoD and respective Service guidance should be in place for JWARS to be installed in user spaces.

The threshold of survivability is that JWARS satisfies all security requirements by the designated accreditation authority (DAA) and site security authorities. Security analysis will examine accounting for users, auditing of access and use, features to prevent unauthorized penetration of the system, and provisions to safeguard continuity of operations (COOP). COOP includes procedures and processes to backup data, archive information when required, restore the system from a non-operational state, and deliberately shutdown the system.

1.4 System Description

JWARS will be a state-of-the-art, analytic model of multi-sided joint military operations. Its object-oriented (OO) design includes balanced representations of joint theater warfare in a realistic environment. The model will consider strategic, operational, and tactical levels of warfare, but will focus on the operational level. Its purpose is to support joint military analysis. The simulation will be sufficiently flexible to deal with current, near-term, and future warfare concepts, doctrine, systems, and organizations of the U.S., its allies, and potential foes. In particular, JWARS will be able to represent and assist in defining the emerging operational concepts of Joint Vision 2010: dominant maneuver, precision engagement, full-dimensional protection, and focused logistics.

The representations of C4 and ISR will enable analysts to factor into their analyses how JWARS objects perceive and interact with one another. JWARS will maintain ground truth and current perceptions for each side. A side's ability to make and execute informed decisions will be directly influenced by that side's perception of the battlefield and the enemy forces in opposition.

(Annex D, System Description Information, elaborates the preceding system description.)

1.4.1 Key Features and Warfare Representation

1.4.1.1 Key Features. The following key features are explained in Annex D, System Description Information, or in the ORD:

- ✓ Classification and Releasability
- ✓ Deterministic and Stochastic Methodology
- ✓ Ease of Use
- ✓ High Level Architecture (HLA)
- ✓ Maintainability
- ✓ Multiple Levels of Resolution

- ✓ Portability
- ✓ Reliability
- ✓ Repeatability
- ✓ Run Control
- ✓ Run Time
- ✓ System Integrity
- ✓ Tailorability
- ✓ Traceability
- ✓ Utility

1.4.1.2 Warfare Representation. JWARS shall include balanced representation of joint warfare in a realistic environment. Appendix B of the ORD lists the initial prioritized warfare functionality desired in JWARS. Appendix C of the ORD contains a further refinement of the JWARS functionality required for the first two releases of JWARS and grouped into the following four areas:

- ✓ Strategic Logistics
- ✓ Tactical Logistics
- ✓ Perception
- ✓ Operations

1.4.2 Interfaces

The current JWARS does not require specific interfaces with any other models or simulations to be operational. However, there may be a requirement for more detailed models or simulations to be run off-line to provide data that can be used as input to JWARS for many of its applications

The JWARS ORD states that the JWARS Office shall comply with the Memorandum of Agreement (MOA) between the JWARS Office and the Joint Simulation System (JSIMS) Program Office which specifies that the two simulations shall share a common Joint Conceptual Model of the Mission Space (CMMS), and to the maximum extent practical, system level interoperability, databases and object characteristics.

1.4.3 System Characteristics

- ✓ The JWARS design must be able to operate at security levels as designated in the ORD, paragraph 4b(10), Classification and Releasability
- ✓ JWARS will be HLA-compliant.

1.5 Critical Technical Parameters. (See Annex F)

1.6 Background For The Test and Evaluation Plan (TEP)

The purpose of this Test and Evaluation Plan (TEP) is to document what the T&E for JWARS will entail. The intent of T&E is to help ensure that military campaign analysts receive in JWARS the modeling and simulation (M&S) capabilities expected. The T&E of JWARS will provide external checks upon development progress and feedback to help the JWARS Office in maintaining robust management control over the JWARS Program.

This Test and Evaluation Plan was drafted by the members of the JWARS WIPT to provide an overview of the testing plans to be used in one part of the JWARS assessment strategy. It discusses both developmental test and evaluation (DT&E) and operational test and evaluation (OT&E). JWARS testing will also draw upon results of V&V of the code and V&V of the data.

The goal of T&E is to help the program mitigate development risk. Such risk includes imprecise requirements analysis, incomplete integration, training shortfalls, insufficient planning for change, and the difficulties inherent in managing complexity. The WIPT will strive to accomplish risk mitigation in a cost-effective and cost-efficient manner.

The DT&E must ensure that system technical requirements are satisfied. Model design V&V ensures that a simulation performs as it was designed and represents the real world in a manner satisfactory for its intended uses. V&V of JWARS data address data sufficiency matters and is executed in addition to the V&V of applications. Joint Data Support (JDS) will provide the required data for the development of JWARS objects and algorithms as well as for the operational model. OT&E must determine if the system will adequately serve the needs of JWARS users and their mission. All of these efforts, in a coordinated manner, will provide a wide-ranging assessment of JWARS.

This TEP contains more information than a Test and Evaluation Master Plan (TEMP) for acquisition programs might. The reason stems from the fact that JWARS is not a pure acquisition program (e.g., in terms of fielding decisions or funding mechanisms). Also, most current analytical simulations have been developed by users from a single organization and may not have gone through a formal Test and Evaluation process. Therefore, many of the personnel involved in the T&E of JWARS are not familiar with the structured, formal T&E terms, paradigms, and techniques found in the acquisition community.

2. INTEGRATED TEST PROGRAM SUMMARY

2.1 Program Schedule. Paragraphs 2.1.1 to 2.1.4 discuss JWARS development, key program events, schedule considerations for each release of JWARS, and the program funding profile.

2.1.1 Development. The JWARS development will be an iterative procedure using object-oriented (OO) design, programming, and engineering processes. JWARS capabilities will be developed in a series of iterations resulting in three fielded releases as indicated in Table 2-1 below. Release 1 will occur after iteration 5 and Release 2 will occur after iteration 9. The total number of iterations for development of Release 3 is still TBD. Each iteration is a set of approximately ten threads, except when development is in parallel with fielding where there could be fewer threads, roughly six, per iteration. Threads are work units of warfare functionality described by intent statements to represent entities, behaviors and interactions, and tailored to support MOE / MOP analysis. Release 1 will contain at least 51 threads that are focused on achieving functional requirements to support Force Assessment applications as defined in Appendix A of the JWARS ORD. The threshold level for Release 2 will be approximately 72 threads. Design details and full functionality for Release 3 are still TBD.

TABLE 2.1 JWARS DEVELOPMENT

RELEASES	CAPABILITIES
Release 1	✓ Uses: Force Assessment Applications as Defined in Appendix A of the ORD ✓ Theater-level Simulation, with Core Warfare Representation ✓ Portray the Impact of C4, ISR and logistics ✓ Will Contain Most of the Functionality of TACWAR and MIDAS
Release 2	✓ Further Development of Release 1 ✓ Uses: Planning and Execution and Force Assessment Applications ✓ Balanced Warfare Representation; More Detail in C4, ISR, Logistics and Maritime Operations ✓ Capable of Replacing Legacy Models TACWAR and MIDAS
Release 3	✓ Further Development of Release 2 ✓ Uses: System Effectiveness and Trade-off Analyses ✓ Uses: Concept and Doctrine Development and Assessment ✓ Balanced Warfare Representation, Added Detail in C4, ISR and Logistics ✓ Capable of Replacing: CEM, THUNDER, ITEM and SUMMITS

2.1.2 Major Program Events

Developer testing of JWARS will occur after each iteration. An Alpha-level test will be conducted after iteration 3 only. This version of the code, referred to as Release 0.5, will contain 31 threads. Informal Beta testing will be conducted on Release 1, which is the first version of the code that will support formal operational testing. The operational testing of this release will include any system assessments to be conducted by the OTAs as part of the OT&E of JWARS. As additional threads are developed for JWARS, continuous evaluation and test reporting will occur. JWARS Release 2 will undergo another round of informal Beta testing and formal OT. Since the details of Release 3 are still TBD, the details of testing for Release 3 are also TBD.

2.1.3 Schedule Considerations

a. Release 1. Release 1 (Limited IOC) is intended to support early operational testing and evaluation of JWARS and to replace the use of TACWAR to support Force Assessment studies. Limited IOC shall occur when at least one JWARS operational site is capable of replacing the use of TACWAR to support Force Assessment studies. Limited IOC (including installation, training, testing, and test modifications) shall occur not later than March 1, 2000.

b. Release 2. Release 2 (Full IOC) is intended to support Planning and Execution studies and Force Assessment studies. Full IOC shall occur when at least one JWARS operational site is capable of supporting Planning and Execution studies and at least one JWARS operational site is capable of supporting Force Assessment studies. Full IOC (including installation, training, testing, and test modifications) shall occur not later than May 1, 2001.

c. Release 3. Release 3 (FOC) is intended to support Planning and Execution studies, Force Assessment studies, System Effectiveness and Trade-of studies, and Concept and Doctrine Development studies. FOC shall occur when at least one JWARS operational site is capable of supporting System Effectiveness and Trade-off studies and at least one JWARS operational site is capable of supporting Concept and Doctrine Development studies. FOC (including installation, training, testing, and test modifications) is anticipated in FY02.

2.1.4 Program Funding

The funding profile for the JWARS and JDS programs is displayed in Table 2-2.

TABLE 2.2 Program Funding

Funded JWARS and JDS Programs ($M), April 2, 1998

Program	Appropriation	FY95-97 Expended	FY98 Execution	FY99 Budget	FY00 Program	FY01 Program	FY02 Program	FY03 Program
JWARS	O&M	17.028	9.017	6.752	9.022	9.246	8.946	5.109
	RDT&E	2.486	2.014	1.847	1.041	0.364	0.200	0.000
	Procurement	2.337	0.272	0.440	0.316	0.229	0.000	0.000
	JWARS total	21.851	11.303	9.039	10.379	9.839	9.146	5.109
JDS	O&M	3.927	2.272	1.616	2.274	2.331	2.632	2.741
	RDT&E	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Procurement	1.092	0.242	0.392	0.399	0.405	0.414	0.422
	JDS total	5.019	2.514	2.008	2.673	2.736	3.046	3.163
Summary	O&M	20.955	11.289	8.368	11.296	11.577	11.578	7.850
	RDT&E	2.486	2.014	1.847	1.041	0.364	0.200	0.000
	Procurement	3.429	0.514	0.832	0.715	0.634	0.414	0.422
	JWARS+JDS total	26.870	13.817	11.047	13.052	12.575	12.192	8.272

Note: Data are based on President's Budget Submission, Feb 98, with further reduction in Mar 98
To FY98 procurement of $19,332 (JWARS -$10,246, JDS -$9086) due to "OSD Withhold."

2.1.5 JWARS Development Schedule

Figure 2.1 displays the JWARS development schedule in terms of thread development and subsequent fielded releases in conjunction with a possible Quadrennial Defense Review (QDR) Study that is assumed to be completed by May 2001.

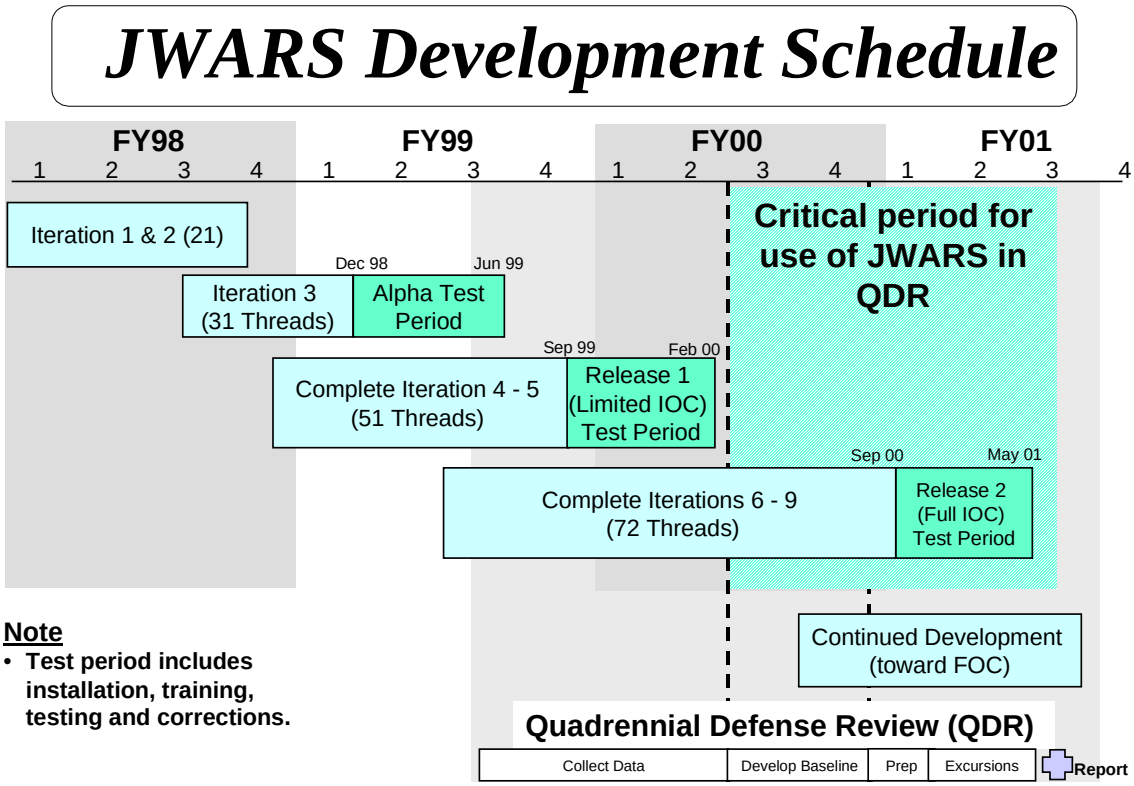

Figure 2.1 JWARS Development Schedule.

2.2 Management

Program management to execute the acquisition strategy and the V&V activities, plus the T&E management to complement the overall program effort will be challenging. The roles and responsibilities of groups and individual agencies involved in JWARS development are listed below in an effort to highlight and coordinate the activities of the various organization.

2.2.1 Joint Analytic Model Improvement Program (JAMIP) Executive Committee (EXCOM)

- Overarching guidance for the JWARS Program
- Milestone Decision Authority

2.2.2 Joint Analytic Model Improvement Program (JAMIP) Steering Committee (SC)

- Monitor progress of the JWARS Program
- Guide and facilitate implementation of the testing strategy in this TEP.
- Oversee T&E progress
- Direct and oversee V&V activities, including approval of V&V Plan and V&V products
- Assist the WIPT in obtaining SME support in the area of military campaign analysis as required to plan and execute high quality T&E.
- Provide recommendations to the Executive Committee regarding overarching guidance to the JWARS Program

2.2.3 JWARS Office

- Provide overall program management for the JWARS Program
- Manage and implement DT&E including developer testing, user tests / alpha tests, and program security
- Facilitate and host WIPT activities
- Facilitate the development of the T&E plan, the V&V plan, and the Alpha Test plan
- Conduct detailed coordination with user test sites on behalf of the WIPT
- Furnish all items that constitute JWARS and are required for T&E. Such items include, but are not limited to, code, training, installation support, test site help-desk support, documentation, and maintenance assistance
- Obtain and distribute information to the WIPT for planning T&E and monitoring progress
- Provide needed information and consolidated progress reports to the JAMIP EXCOM, JAMIP SC, and the WIPT

2.2.4 Joint Staff / J8

- Coordinate WIPT products with user test sites and participants
- Develop JWARS Fielding schedule (to include training and installation)
- Develop JWARS Configuration Management Plan
- Member of the WIPT representing the joint community
- Test site for Joint Staff analysis
- DJ-8 as Configuration Management Authority (CMA)
  - Approves the Configuration Management Plan
  - Approves changes to the configuration-managed baseline of JWARS as defined by the Configuration Management Plan

2.2.5 Working Integrated Product Team (WIPT)

- Assist in the coordination of the T&E effort and of the resources required
- Oversee the integration of the V&V and T&E efforts
- Oversee supporting documentation
- Review test results
- Provide recommendations on V&V and T&E activities to JAMIP Steering Committee

2.2.6 U.S. Army Operational Test and Evaluation Command (OPTEC)

The U.S. Army Operational Test and Evaluation Command (OPTEC) is the Lead Operational Test Activity (OTA) and will implement OPTEC System Team (OST) methodology for the OTAs working with the WIPT. The U.S. Navy Operational Test and Evaluation Force (OPTEVFOR), the U.S. Marine Corps Operational Test and Evaluation Activity (MCOTEA), and the U.S. Air Force Operational Test and Evaluation Center (AFOTEC) are Participating OTAs at their option. Representatives from Participating OTAs will work within the OST structure. Subject to guidance from the Commanding General, OPTEC, or Commander, OEC, the OST Chair will be the point of contact to resolve any OT&E issues that might arise. OPTEC members of the OST will work with members from the Participating OTAs to present a standardized set of OT&E terminology, paradigms, and techniques to the non-OTA members of the WIPT. The terminology, paradigms, and techniques will be OPTEC's, except when a Participating OTA or other involved T&E or V&V organization identifies a new, cost-effective concept that can improve the T&E of JWARS. Participating OTAs will send representatives empowered and competent to represent their organization without seeking additional guidance except under unusual circumstances.

- Develop in collaboration with the WIPT, particularly the user community, T&E plans sufficient to satisfy the OT&E requirements to address JWARS as a total system in terms of effectiveness, suitability, and survivability
- Address the concerns of all OTAs, other involved T&E agencies, and the Services they advocate, in a single System Evaluation Plan (SEP) and Event Design Plan (EDP) for the OT&E of versions of JWARS that will be released for real mission tasks (using the Lead OTA's methodology)
- Obtain the participation of SMEs from non-OTA organizations in the OST as required to plan, execute, analyze, and report in a credible, comprehensive, valid, and clear manner.
- Facilitate coordination in the WIPT between T&E organizations and other agencies
- Review T&E plans and reports, and advise other WIPT organizations, particularly the JWARS Office, in T&E matters and risk assessment
- Conduct Continuous Evaluation of JWARS as a total system (software, infrastructure, human elements, and support items)

- Work to identify and incorporate operational testing measures into testing as early as possible as means of risk mitigation and to pilot-test operational test data collection methodology
- Collaborate with WIPT organizations to develop and implement software performance metrics to monitor progress of JWARS development toward achieving its intended operational capabilities
- Monitor V&V and data preparation activities to obtain information for OT&E planning and analysis. OPTEC members of the OST will take the lead in monitoring V&V. Non-OPTEC members of the OST may directly monitor V&V as their other job requirements permit and they see the need to do so.
- Establish reporting procedures to ensure that the all members of the OST and their sponsoring OTA chains of command are kept informed
- Report independent operational evaluation of each version of JWARS to be released for real mission tasks through the JAMIP SC to JAMIP EXCOM considering all appropriate sources of data, but based primarily upon operational testing data
- Provide WIPT member to represent Army T&E Community

2.2.7 Director, Operational Test and Evaluation (DOT&E)

- Provide guidance to the OST
- Represent the OTAs in the JAMIP EXCOM and SC
- Advocate principles of independent OT&E in ensuring users receive effective, suitable, and survivable systems
- Assist JDS in obtaining data on operational performance of military systems and combat units to be used as input to JWARS
- Assist the V&V agent in obtaining data on operational outcomes for JWARS validation

2.2.8 Initial Lead Integrating Agent for T&E and V&V (Mitre)

- Responsible for the initial integration and coordination of JWARS T&E and V&V activities
- Responsible for developing a draft strategy document for evaluating the integration of JWARS T&E and V&V
- Initial monitor of efforts of JWARS development contractor, V&V agent, T&E facilitator, and the Lead OTA, to ensure that simulation / system quality and performance are achieved in a coordinated manner, to avoid duplication of effort and to reduce program risk and cost

2.2.9 U.S. Army Training and Doctrine Command (TRADOC) Analysis Center, Fort Leavenworth, KS (TRAC-FLVN)

- Assist the JWARS office in the development and implementation of software performance metrics to monitor progress of JWARS development toward achieving its intended operational capabilities
- Participate with the OST in planning JWARS suitability measures

2.2.10 U.S. Army Center for Army Analysis (CAA)

- Test site for Army Analysis
- Member of WIPT representing Army analysis community

2.2.11 U.S. Navy N81

- Test site for Naval Analysis
- Member of WIPT representing Navy analysis community

2.2.12 U.S. Navy N91

- HQ Test Organization for U.S. Navy
- Member of WIPT representing Navy T&E community

2.2.13 U.S. Navy Operational Test and Evaluation Force (OPTEVFOR)

- OTA on OST
- Member of WIPT representing Navy T&E community

2.2.14 U.S. Air Force Studies and Analyses Agency (AFSAA)

- Test site for Air Force
- Member of WIPT representing Air Force analysis community

2.2.15 U.S. Air Force Test and Evaluation Directorate (USAF/TE)

- HQ for Air Force T&E
- Member of WIPT representing Air Force T&E community

2.2.16 U.S. Air Force Operational Test and Evaluation Center (AFOTEC)

- Provide part-time Air Force OTA representative on OST

- Include AFOTEC and Air Force concerns in the OT&E documents developed using OPTEC process
- Participate in data collection and evaluation process
- Facilitate obtaining Air Force testers and data collectors from non-OTA organizations
- Work closely with Air Force users to assure their campaign level modeling requirements and concerns are being sufficiently addressed in the JWARS development
- Assist in the formal coordination of T&E documents within AFOTEC
- Member of WIPT representing Air Force OT&E community
- Travel TDY for OST and WIPT meetings using OPTEC JWARS funding

2.2.17 U.S. Marine Corps Combat Development Center (MCCDC)

- Test site for Marine Corps
- Member of WIPT representing Marine analysis community

2.2.18 U.S. Marine Corps Operational Test and Evaluation Activity (MCOTEA)

- OTA on OST
- Member of WIPT representing Marine Corps T&E community

2.2.19 PA&E Simulation and Analysis Center, PA&E (SAC)

- Test site for PA&E
- Member of WIPT

2.2.20 Joint Data Support (JDS)

- Provide test data sets to test sites
- Provide representation on the test site installation teams to familiarize users with the test data
- Advise JWARS developers on availability of data to support object representations and algorithms
- Facilitate the verification and validation of data
- Advisor to WIPT

2.2.21 Configuration Control Board (CCB)

- Adjudicates issues related to ORD that arise during development
- Monitors implementation and renders interpretations of requirements
- Leads generation of baseline requirements for follow-on versions

- Deliberate all baseline change proposals
- Recommend baseline requirements changes to Configuration Management Authority (CMA)
- Observer to the WIPT

2.2.22 Defense Modeling and Simulation Office (DMSO)

- Lead DoD organization on M&S policy
- Advisor to WIPT

2.2.23 Verification and Validation (V&V) Agent (BMH-IMC)

- Facilitate the V&V of JWARS (responsibilities contained in V&V Plan)
- Work with Services for U.S. forces and systems validation and with intelligence community for threat validation
- Advisor to WIPT

2.2.24 T&E Facilitator (Institute for Defense Analyses)

- Assists in documenting and coordinating T&E planning
- Advisor to WIPT

2.2.25 Security DAA Representative

- Responsible for security interests that surround the development and testing of JWARS

2.2.26 Standards Profile Representative

- DMSO to certify HLA compliance

3. DEVELOPMENTAL TEST AND EVALUATION (DT&E)

3.1 DT&E Overview

DT&E includes all levels of testing conducted under the direct or indirect management control of the JWARS Office plus the cooperating and concurrent V&V activities under management control of the JAMIP (SC).

DT&E is intended to accomplish the following:

- ✓ gain basic understanding and insight as to how the model behaves and how it should be properly employed as an analytic tool
- ✓ ensure that the system developer is meeting contractual requirements in the level of detail, scope and functionality being designed into the JWARS code
- ✓ enable users to assess the usability and utility of JWARS, and to identify incorrect code behavior; find and eliminate coding errors
- ✓ provide the JWARS Office the opportunity to get sufficient early feedback on the development process and the usefulness of the model in order to influence development to provide the best JWARS possible with the resources available
- ✓ support software performance metrics to monitor developmental progress toward JWARS operational capabilities
- ✓ address traceability, the ability to identify why a certain output was obtained from JWARS, to the extent that the software development will allow
- ✓ ensure, in conjunction with V&V, that JWARS demonstrate and enable the correct representation of doctrine, system and unit performance, the environment and balance among joint warfare functions for U.S. forces, allies, coalition partners and potential adversaries
- ✓ assess utility of JWARS, the ability to support essential study execution, to possess deterministic and stochastic assessment methodologies, multiple levels of resolution, and acceptable run times
- ✓ address system integrity, the ability to protect the hardware system, software code, and data integrity from alteration or compromise
- ✓ assess reliability, the ability of JWARS to perform a simulation under stated conditions for a specified period of time
- ✓ assess repeatability, the ability of JWARS to reproduce results of a single simulation run
- ✓ address special program interests to include, but not limited to, security accreditation, availability of data from sources as required for JWARS, and integration of the JWARS efforts with other M&S efforts when beneficial to both and not inhibiting the approved JWARS T&E strategy
- ✓ report quality assurance results as input to the CM process

DT&E will be made up of three parts:

- ✓ developer testing, to include software testing, under direction of the JWARS office and overseen by SMEs.
- ✓ implementation verification and results validation by the V&V agent and SMEs
- ✓ alpha testing and some informal beta testing, to be performed by Service sites and analytic / study agency sites

Developer testing consists of build, integration and system tests that will be performed on each iteration and version of the model. These tests taken together with the V&V activities verify the software and system technical requirements of JWARS.

At the completion of each JWARS iteration, various levels of developer and software testing, code verification, and results validation will be conducted to provide feedback to the development process. At the completion of the third iteration (after pre-release testing by the developer, and acceptance testing by the JWARS Office), Service sites and analytic / study organizations (i.e., potential users) will be asked to perform Alpha Testing on this version of the JWARS code and provide early feedback to the developer. The purpose of Alpha Testing is to have potential users identify software faults or incorrect code behavior; evaluate specific modules of the code; evaluate the specific, but limited, warfare representations included in this iteration; and in general, assess the work flow involved in using the model. In this manner, the JWARS community can gain experience with the model, assess the usability and utility of the code, and begin planning how to do a study using JWARS.

There are lower level incremental tests such as unit tests, integration tests, thread tests, and system tests, which are conducted by the developer during developer testing. These tests are used to minimize the design risks, demonstrate software development progress, and serves as the basis for code verification and results validation of the incremental versions of the JWARS code.

3.1.1 Developer Testing

There are two categories of tests that the developer has identified and will employ—informal tests and formal tests. Informal tests are an integral part of the software development process and are documented in the Software Project Management Plan (SPMP). The formal tests to be performed are described in the Software Test Plan (STP) and the Software Test Design (STD). The characteristics of these two test categories are:

<u>Informal Tests</u>

- ✓ Do not require testing with code under configuration control, i.e., allows the find-and-fix process
- ✓ Have specific levels and content (of these tests) defined by the Software Development Process in the SPMP

- ✓ Performed by developer contractor
- ✓ Do not require government witness or approval

Formal Tests
- ✓ Use code under configuration control
- ✓ Follow government approved test plan and procedures (STP & STD)
- ✓ Performed by a Test Team (developer contractor for JWARS)
- ✓ Witnessed and approved/disapproved by government representatives
- ✓ Results are documented in a Software Test Report (a deliverable)

3.1.1.1 Unit Test and Integration Test

Unit tests and integration tests represent the first level of developer tests and are considered informal tests. Unit testing is a term that refers to programmers testing low-level code. Sometimes it is done by the originator of the code and sometimes by a peer. It is part of the Software Development Process and is subject to those policies and guidelines. Unit tests are not deliverable and typically contain only enough documentation for the knowledgeable programmer to understand what it does and what the results should be. Typically, the tests are saved so they can be repeated if a question arises about the code. Sometimes the results also are saved to a file so that (1) it documents the results and (2) if the test is repeated the results can be evaluated by comparing the files.

Integration tests are tests in which developers on different teams make their code work together. Ultimately, when all software has been integrated and works satisfactorily together, it can enter System Testing, which is the next level of developer testing. System testing is formal testing and is described in a later section.

Unit tests and integration tests may be observed by Government representatives and/or the V&V agent. However, there is no sign-off required at this level of testing. In addition, the only documentation requirements are internal to the developer as called for in the SDP practices. SDP practices and quality assurance (QA) practices include code inspections and reviews where compliance is “enforced.”

3.1.1.2 Thread Tests

Thread testing is formal testing that is done at the end of each iteration. Thread testing is a form of system testing in the sense that it tests the “system” at intermediate stages of development. Thread testing is typically more rigorous within a thread than when performed during system testing.

3.1.1.3 Use Case Tests

The Human-Computer Interface (HCI) is developed by the Platform Domain team. The Platform Domain consists of the Developers' Environment, the Entity Modeler Environment, and the Analyst Environment. "Use Cases" are descriptions of a sequence of operations by a user. Use Case tests are formal tests designed to show that the actions performed by the user occur and cause specific changes correctly. Use-Case testing will occur prior to any Alpha or operational tests.

3.1.1.4 System Tests

System tests evaluate whether the integrated system as a whole has the correct functional behavior and sequence for that point in development. System tests are formal tests that are performed in addition to thread tests at certain checkpoints. At the end of iteration 3, system testing will be performed after normal thread testing when the iteration is complete. For this iteration, referred to as Release 0.5, the functionality of the system will be incomplete or will have untested functionality. Release 1, which is at least a 51-thread version of JWARS, will undergo extensive system testing.

3.1.1.5 Acceptance Tests

Developer acceptance testing is formal system testing by the development contractors for the JWARS Office. Acceptance testing is for the specific purpose of acknowledging that delivered software fulfills contractual obligations. As a minimum, selected users will examine the system for usability and early functionality. Acceptance tests are performed prior to any version of the code being officially released to users.

3.1.2 Verification and Validation (V&V) (of Software Development)

Verification and Validation (V&V) is not a test activity, but involves following the software development process from beginning to end and ensuring that requirements are traceable throughout the development process, culminating in running code and evaluating the results. The main V&V activities are mission space description validation, derived requirements validation, design products verification, algorithm validation, implementation verification, and results validation. Details about these processes are in the JWARS V&V Plan. The V&V contractor will observe as much of the unit, system, and acceptance testing as possible. This will be done unobtrusively in order to minimize additional work for the developer. The synergy of V&V and T&E allows the two activities to use much of the same test data and test results, which should enhance efficiency and reduce cost. Plans will be coordinated to minimize duplication.

3.1.3 Verification and Validation (of Data)

Data verification is the use of techniques and procedures to ensure that data meet constraints defined by data standards and business rules derived from process and data modeling. Data validation is the documented assessment of data by subject matter experts and its comparison to known values. Data imbedded in code or algorithms within JWARS will be evaluated in conjunction with the V&V process. The JDS will facilitate the verification and validation of the data sets for the development of objects and algorithms, as well as the input data needed to run and use the operational model.

3.1.4 Alpha Testing

The purpose of Alpha Testing is to have potential users (i.e., the identified testers) assess the workflow involved in using the model and provide early feedback to the developers. The idea of workflow will focus on getting a feel for the model, assessing the usability and utility of the code, and providing a better understanding of the problems involved in doing a study using the model. In addition, these potential users will be given the opportunity to identify software faults and incorrect code behavior, and to evaluate specific modules of the code and specific warfare representations. Alpha testing will be conducted for Release 0.5 only.

The Joint Staff, selected CINCs, OSD (PA&E), and other study agencies, will be given the opportunity to participate in Alpha testing of the JWARS code.

3.1.5 Beta Testing

The purpose of Beta testing is to allow potential users to informally test areas or evaluate modules they are specifically interested in with respect to the JWARS design, and to make recommendations to the developer for future changes. In this process the users have the opportunity to become more familiar with the code and evaluate its overall utility. As used here, Beta testing, which will be conducted for Releases 1, 2, and 3, interacts at both the developmental and operational levels of testing. Results from Beta tests also provide the OST with additional data for their use in the operational assessment and evaluation of JWARS. Individual Service sites plus other analytic organizations, to include OSD (PA&E), the Joint Staff, selected CINCs, and other study agencies, will be given the opportunity to participate in Beta testing of the JWARS code.

There are documents, such as the JAD Packets, the Thread Documents, and the Software Requirements Specification (SRS), that describe measures of effectiveness (MOEs), measures of performance (MOPs), and requirements traceability that should

be quite useful to the JWARS testers. (Note: The MOEs are derived from the ORD and are repeated in the JADs. Also, the SRS is presented in the form of a requirements-traceability matrix which, for each requirement that is applicable to JWARS, identifies its source, the functional allocation and the test methods to be used for each requirement).

3.2 Future Developmental Test and Evaluation

The JWARS simulation will undergo developer testing, software testing, and V&V assessments at each iteration of the development process. At the end of the third iteration the model will be presented to potential users for their evaluation as part of the Alpha Testing. The operational assessment of JWARS will be coordinated within the WIPT when the OST produces its System Evaluation Plan (SEP). The assessment and evaluation results of each DT, V&V (of software), and V&V (of data) will be captured in formal and informal documentation.

3.2.1 Release 0.5 System Test

a. Configuration Description. Release 0.5 consists of 31 threads, or about forty percent of JWARS functionally that is expected by Release 2. Release 0.5 is the first, and only, version that is planned to be available for Alpha testing. It will have multiple conceptual modules provided by the developer and will include: primitive environment objects, limited exercise control, limited text output on situation and status reports, limited interaction between objects, and limited ability to exercise JWARS architecture.

The following functions are available for partial testing at this level:

- Sensor and intelligence threads; command and control threads; logistics on operational threads
- Mission Space Objects (C4, ISR, joint, land, maritime, mobility, environment)
- Modeling Framework
- JWARS Object Services (federation objects, object management framework, common data infrastructure)

b. Testing Objectives

- Evaluate the core infrastructure and modeling framework capabilities
- Show that the developed modules will integrate with the JWARS core infrastructure emphasizing the interface domain process.
- Verify that system design is consistent with baseline system architecture
- Be able to select modules from the repository and construct simple scenarios
- Test the collection of threads as they are defined for iteration 1, 2, and 3 JAD Packets

c. Testing Events, Scope of Testing, Basic Scenarios. The specific events and the scope of
testing envisioned within this testing level include all informal and formal testing described above. Users will be involved in all phases of Alpha testing. These two points will be central to all DT&E events.

JWARS uses scenarios as a basis for model development. In general, a military scenario is a "big picture" description of a military problem or situation that provides context for analysis. It provides a setting that helps an analyst identify issues and factors bearing on the analysis. It is not necessary for a scenario to be an accurate representation of an actual world situation or event. It may be a hypothetical problem that provides a setting that will offer situational events and a geographic environment that will permit problem development in a realistic world setting.

The scenario for the Alpha test of JWARS is set in the Middle East Persian Gulf region as the geographic area for problem development. The test plan for this scenario is written for a JTF-level operation that is designed to execute a MTW mission. It incorporates only those aspects of a traditional military plan needed to provide a framework for the JWARS Mission Space Model. The plan provides an operational foundation that will permit development of the threads needed for software development. Data imbedded in code or algorithms within JWARS will be evaluated in conjunction with the V&V process. JDS will provide the required data for the development of JWARS objects and algorithms as well as for the operational model.

d. Test Limitations. None.

3.2.2 Release 1 System Test

a. Configuration Description. Release 1 (Limited IOC) will consist of at least 51 threads, or about 70 percent of the code envisioned at Release 2. Release 1 is intended to support early operational test and evaluation of JWARS and to replace TACWAR to support Force Assessment studies (as described in Appendix A of the JWARS ORD). Release 1 shall include C4, ISR, logistics capabilities, and essential functionality that exists in the current MIDAS and TACWAR models (threshold functionality is described at Appendix C of the JWARS ORD). Release 1 is the first version of JWARS for which informal beta testing will be conducted (described above) and which will support formal operational testing (detailed in Part 4 of this plan).

b. Testing Objectives

- Assess capability of model to perform functions available [for assessing Force Assessment applications]
- Analyze output against that from existing TACWAR and MIDAS models

- Gain insight into model behavior and appropriate employment techniques for both deterministic and stochastic modes of operation
- Conduct re-testing of tested areas, as required

c. Testing Events, Scope of Testing, Basic Scenarios. Individual test sites will test specific combat functionality of the objects that have been developed, verified and made available in this version of the code. The scope of testing at this point in development will focus on validating model behavior and joint campaign analysis including the following:

- Joint and combined combat scenarios for test of JWARS analysis applications
- Individually selected scenarios for Service sites' test of combat functionality
- Joint and combined air and space operations, implementation of an ATO
- Offensive and defensive land and amphibious combat operations, with maneuver
- Maritime surface and sub-surface operations
- Sea-lift and air-lift mobility actions

JWARS will use the Mobility Requirements Study-2005 (MRS-05) scenario for Release 1 system testing to provide a current and recently analyzed context for conducting test events. The initial focus of the JWARS analysis will be the first MTW from the MRS-05 swing scenario, although additional MRS-05 scenarios will be added as data and functionality are made available. These scenarios will provide the opportunity to include comparisons with TACWAR and MIDAS results that were generated in the MRS-05 analysis. Any data imbedded in code or algorithms within JWARS will be evaluated in conjunction with the V&V process. JDS will facilitate the verification and validation of the input data sets needed to run and use JWARS.

d. Test Limitations. None.

3.2.3 Release 2 System Test

a. Configuration Description. Release 2 (Full IOC) will consist of at least 72 threads and provides increased warfare functionality to support operational analyses. Release 2 is intended to support Planning and Execution studies and Force Assessment studies (these applications are described at Appendix A of the JWARS ORD). Release 2 shall provide balanced warfare representation to include C4, ISR, and logistics and shall be capable of replacing the legacy campaign models TACWAR and MIDAS (threshold functionality is described at Appendix C of the JWARS ORD).

b. Testing Objectives

- Assess capability of model to perform functions available [for conducting Planning and Execution and Force Assessment applications]

- Determine if JWARS is fully capable of replacing TACWAR and MIDAS
- Identify critical software modifications prior to OT
- Assess technical implications of stochastic and deterministic assessment design
- Conduct re-testing of tested areas, as required

c. Testing Events, Scope of Testing, Basic Scenarios. Individual test sites will test specific combat functionality of the objects that have been developed, verified and made available in this version of the code. The scope of testing at this point in development will focus on validating model behavior and joint campaign analysis including the following:

- Joint and combined combat scenario for test of JWARS analysis applications
- Joint and combined land, air and naval operations

The basic scenario to be used for testing Release 2 is still TBD. However, it is envisioned that JWARS will examine scenarios comprehensive enough to address all requirements for Release 2 as specified in the JWARS ORD.

d. Test Limitations. None.

3.2.4 Release 3 System Test

a. Configuration Description. The number of threads and specific functionality that will define Release 3 (FOC) are still to be determined. Release 3 is intended to support the following applications described at Appendix A of the JWARS ORD: Planning and Execution, Force Assessment, System Effectiveness and Trade-off Analysis, and Concept and Doctrine Development. Release 3 shall provide balanced warfare representation to include C4, ISR, and logistics, and in addition to the functionality of Release 2, shall be capable of replacing the legacy campaign models CEM, THUNDER, ITEM, and SUMMITS.

b. Testing Objectives

- Assess capability of model to perform functions available [for conducting Planning and Execution and Force Assessment applications, System Effectiveness and Trade-off Analyses, and Concept and Doctrine Development.]
- Assess fidelity of model to represent balanced warfare at a higher level of resolution than previous releases
- Identify critical software modifications prior to OT
- Assess technical implementation of variable resolution design
- Conduct re-testing of tested areas, as required

c. Testing Events, Scope of Testing, Basic Scenarios. Individual test sites will test specific combat functionality of the objects that have been developed, verified and made available in this version of the code. The scope of testing at this point in development will focus on validating model behavior and joint campaign analysis including the following:

- Joint and combined combat scenario for test of JWARS analysis applications
- Joint and combined land, air and naval operations

The basic scenario to be used for testing Release 3 is still TBD. However, it is envisioned that JWARS will examine scenarios comprehensive enough to address all requirements for Release 3 as specified in the JWARS ORD.

d. Test Limitations. None.

4. PART IV - OPERATIONAL TEST AND EVALUATION (OT&E)

4.1 OT&E Overview

The primary purpose of OT&E is to report how operationally effective, suitable, and survivable systems are before they are delivered to the intended users. The JWARS Office has adopted an incremental acquisition strategy to develop and field three releases of JWARS functionality, along with an early release (Release 0.5) for Alpha testing. In collaboration with the other T&E and user organizations involved, the OST has developed an OT&E strategy aligned with the JWARS acquisition strategy. The OST intends to provide Operational Assessments of Releases 1 & 2 and an Operational Evaluation of Release 3. Data to support the assessment of each JWARS release will be obtained from DT&E, V&V, separate informal Beta tests, and formal operational testing activities. The OST will conduct Continuous Evaluation of all of these events to obtain planning information and help to provide risk mitigation. To the extent feasible and practical, the OST will assess the capability of JWARS to use system performance data from prior operational tests and actual operations. The evaluations will be provided as input through the JAMIP SC to the JAMIP EXCOM for fielding decisions.

a. OT&E has never before been conducted upon an analytical model with the scale of JWARS. There are two broads goals associated with OT&E. One goal is explicit and the other is implicit. The explicit goal is to report the effectiveness, suitability, and survivability of a system to the decision-makers who may authorize it to be fielded. In such reporting, an Operational Test Activity (OTA) must base findings and recommendations primarily upon evidence from typical users operating and maintaining the system under operationally realistic conditions as intended and with projected levels of workload. The implicit goal is to help ensure that users receive systems that actually meet their mission needs and operational requirements. This means that the OTAs will work with the stakeholder organizations involved with JWARS to plan means to mitigate risks associated with a software-intensive system.

b. The JWARS OST categorizes such risks into requirements interpretation, integration, training, change management, and management of complexity. Although the techniques that the OST will use in dealing with risk may be quantitative in part, they are mostly qualitative in nature. For example, the OST will tailor and consolidate existing software developmental progress review checklists to fit the JWARS program. The OST will work with the JWARS Office and users to develop metrics that reflect developmental progress toward achieving the operational capabilities that will be observed in the course of OT&E.

c. The OST will practice early involvement. The OST will participate in the JWARS T&E / V&V WIPT for planning and monitoring T&E and V&V progress. When requested, the OST will advise the JWARS Office and users with test planning. The OST will assist the JWARS T&E / V&V WIPT in implementing operational testing measures as early as possible in order to increase the probability of success for JWARS. Operational testing measures will consider the conditions for observations required as input for OT&E. The conditions will include simulation runs conducted for sensitivity analysis and demonstrating use of different types of data, e.g., performance parameters from operational testing of materiel systems and data from live operations. The JWARS T&E / V&V WIPT envisions that the risk mitigation effort will lead to the integration of the requirements and schedule databases for JWARS with databases for planning, tracking, and reporting DT&E, V&V, and OT&E results. (Record operational test data will be released IAW OPTEC policy.)

d. We will monitor V&V to learn from users during the course of V&V their concerns potentially impacting the effectiveness, suitability, and survivability of JWARS to satisfy its mission needs and operational requirements pertaining to each Release. We will consider the V&V process and results in identifying conditions to be included in JWARS observations for OT&E, and in analyzing effectiveness. In order to maintain appropriate independence in OT&E reporting and to avoid conflict of interest perceptions, the OTAs will not verify, validate, accredit, or certify any performance, characteristics, or features related to JWARS. The OST may have to discuss observed operational impacts related to shortfalls in DT&E and V&V. This restriction applies to software, data, hardware, standards compliance, and security accreditation. Verification, validation, and any certifications that may be required for fielding are responsibilities of the JWARS Office and JWARS users. The JWARS V&V Agent will conduct the validation of the algorithms of JWARS. A senior user for the intended use of a model must perform accreditation. OT&E addresses verification, validation, accreditation, and certifications to obtain information for planning, analyzing, and reporting the effectiveness, suitability, and survivability of a system undergoing OT&E. In the case of JWARS, the OST intends to inform JWARS decision-makers through independent OT&E reports regarding information they should consider before their fielding decisions. Another intent is to monitor and advise the JWARS Office regarding developmental activity as a method of assisting the JWARS Office in mitigating programmatic risks. The OST will emphasize in its approach to risk mitigation how to avoid fielding problems based upon lessons learned during the OT&E of other systems.

e. Participating OTAs will not publish or present separate findings from OPTEC reports prepared by the OST. The analysis and evaluation of their representatives in the OST will be incorporated into OPTEC reports. OST members will work to resolve all OT&E concerns at the lowest possible level. OST members may elevate issues to their OTA command level. If the OTA commanders decide a dissenting input is appropriate,

the OST member from the dissenting OTA will prepare a complete analysis, findings, and recommendations for enclosure in the OPTEC report.

f. OPTEC will charter, train, and chair a Data Authentication Group (DAG) in the Event Design Plan (EDP) prepared by the OST for each JWARS release. The DAG will include representatives from the Services, J8, JWARS Office, V&V Agent, and OST. Other agencies may participate at their option. The DAG will examine data before its incorporation into OT&E findings to authenticate it was collected in a complete, accurate, and valid manner as prescribed in OT&E planning documents. The DAG will produce official minutes for archiving. The DAG recommendations will be submitted to the OST Chair who will make a final determination. DAG members who dissent from the majority position must provide their dissent in writing.

g. The OST will use both automated and manual data collection for its OT&E. The data collection methodology will be more precisely described in the JWARS SEP and in each EDP. An EDP will address OT&E data management in terms of collection, quality assurance, reduction, and display production. Data collection includes observations, surveys, and interviews at the analytical organization sites that will use JWARS. This data collection is intended to help ensure OT&E planning adequately considers the requirements of the Services, the CINCs, the Joint Staff, and OSD.

h. In this TEP, the term assessment carries a special connotation. Ordinarily in OPTEC terminology, assessment means to evaluate in a less than complete manner. Typically, an assessment is how OPTEC evaluates a system with less than its full objective capabilities available. An assessment may also address modifications to a system that do not significantly change its core capabilities. Since JWARS is a simulation, the guidelines for models and simulations apply to JWARS. Those guidelines clearly indicate that simulation developers and users are ultimately responsible for its verification and validation/accreditation, respectively. The operational effectiveness, suitability, and survivability objectives include the word assessment in recognition of three considerations: First, the OST will not perform verification, validation, or accreditation. Second, the responsibility for some areas to be addressed in our OT&E belongs to other agencies, e.g., certifications and security accreditation. Third, some requirements of JWARS are difficult to define, particularly "balanced warfare." The assessments of the OST will be to determine how well JWARS satisfied the users expectations, has progressed toward achieving programmatic requirements for fielding, or both. The OST will work with user SMEs to identify the user acceptance criteria that reflect the expectations of the users. Such criteria will be measurable aspects and thresholds of JWARS performance, characteristics, or features.

i. The generic methodology for JWARS operational effectiveness assessments includes the following: (1) The OST will work with the JWARS T&E / V&V WIPT and

operational test site representatives to analyze the tasks users will perform using JWARS and which of those tasks are the users' highest priorities. (2) The OST will perform critical mission function analysis (CMFA) to derive a JWARS performance-sampling matrix. The matrix will address the critical operational issues and criteria (COIC) and derived functional requirements associated with the release undergoing OT&E. The matrix will be adjusted by the OST considering DT&E and V&V results. The matrix will include sufficient numbers of observations to analyze JWARS performance in terms of the conditions the evaluators identify. As a minimum, such conditions will include types of analysis, organizational partitions, functional partitions, and the major types of input data (including data from operational testing and live operations). Functional partitioning is to be conducted by the JWARS T&E / V&V WIPT. The experimental design for a JWARS performance sampling matrix will factor in confidence, repeatability, diagnostic utility, deterministic versus stochastic, and sensitivity analysis considerations. (3) The OST will work with functional proponents and test site representatives to clarify user acceptance criteria. User acceptance criteria will be considered in operational test data collection planning and analysis of operational testing results. User acceptance criteria are interpretations of the JWARS requirements that ensure they are testable. The OST must clearly understand user expectations. (4) The OST will score, then analyze, their JWARS performance observations with the assistance of user SMEs. Although the OST may receive user SME assistance in scoring and analysis, the OST members are independently responsible for their OT&E analysis. They will apply sound military and engineering judgement in deriving their findings.

j. The OST will strive toward balancing the demands for OT&E credibility, efficiency, and economy. Operational testing will be limited to what is required to satisfy the principles of independence and credibility in OT&E. The detailed resource estimate for OT&E will be documented in three Outline Test Plans (OTPs), one for each JWARS release. The U.S. Army Test and Experimentation Command (TEXCOM) will be responsible for the OTPs. The resource estimate for OT&E included in this TEP may be revised by OPTEC after more information is obtained regarding JWARS.

k. The OTAs will require separate and direct coordination for providing operational test data for use in JWARS simulation.

4.1.1 Operational Test Readiness Review (OTRR). Prior to the separate operational testing for each release of JWARS , the following must be reported to the OST in OTRRs so that the OST can report that it is prepared to collect data planned for use in the evaluation analysis
:

- ✓ JWARS Office ensures that JWARS is ready to enter OT&E in terms of meeting the applicable ORD requirements.
- ✓ JWARS Office certifies that security requirements have been addressed.

- ✓ JWARS Office provides the fielding test support packages, including training packages.
- ✓ JWARS Office provides user personnel training.
- ✓ JWARS Office certifies the degree of Y2K compliance of the JWARS system.
- ✓ User representatives certify that users are ready for test.

There will be three OTRRs for each JWARS Release. An OTRR 1 will review the OT&E strategy. An OTRR 2 will consider whether the OST may deploy to operational testing sites. An OTRR 3 will address whether the OST may proceed into record operational testing. OTRRs are chaired by the Commanding General, U.S. Army Test and Experimentation Command, or his designated representative. The OST will coordinate with the JWARS Office to schedule OTRRs on the JWARS master schedule. OTRRs should be scheduled in a manner that supports or at least minimizes disruption of other scheduled activities. Representatives from the JWARS Office and V&V Agent should attend the OTRRs. TEXCOM will determine if physical attendance will be required. More specific OTRR directives will be covered in the JWARS SEP.

4.2 Operational Issues

The JWARS critical operational issues (COIs) and additional issues (AIs) are identified below and described in Appendix E. COIs are questions that must be answered in order to evaluate the operational effectiveness, suitability, and survivability of a system undergoing T&E (SUTE). If every critical operational issue is resolved favorably, the system should be operationally effective, suitable, and survivable when employed in its intended environment by typical users. The judgement of the OTAs is used to determine if a COI is favorably resolved. COIs must be approved by the organizations that generate the requirements for the SUTE. (The JWARS COIs are approved with approval of this TEP).

AIs are questions that should be answered to provide a thorough basis for the evaluation. AIs are identified by OST. Since OPTEC is the Lead OTA, the Army COI and AI methodology will be used. That methodology requires amplification of the COIs in terms of scope, criteria, and rationale, as well as the description of AIs in regards to scope and rationale. AIs have no criteria, because they are simply a framework to investigate matters that influence COI findings, detect and analyze system shortfalls, satisfy certain T&E policies, and explore items of interest to the user community. (Annex E provides the COIs, COI criteria and rationale, and AIs.)

COI 1 Mission performance. *Does JWARS support the ORD-defined modeling and simulation needs of the OSD, the Joint Staff, the Services, the CINCs, and others to support planning and execution, force assessment, system effectiveness and trade-off analysis, and concept and doctrine development?*

COI 2 – Business Process Support. *Does JWARS have the capability to support user-unique approaches to the preparation and execution of simulations?*

COI 3 – Human-Systems Integration (HSI). *Can typical user personnel that are trained to use, operate, maintain, and supervise modeling and simulation operations, perform these duties in a satisfactory manner using JWARS?*

AI 1 – Database Management. *Are there processes and procedures in place to provide the data for JWARS to operate as required?*

AI 2 – Logistics and Maintenance. *Is the integrated support planned for JWARS sufficient to sustain it for its foreseeable length of Service?*

AI 3 – Security. *Does the use of JWARS in its intended operational environment satisfy applicable security requirements?*

4.3 Future Operational Test and Evaluation

The JWARS will undergo OT&E in support of the three release decisions: Releases 1, 2 and 3. The OST will prepare a system assessment for the first two releases and a system evaluation for the last.

4.3.1 Release 1. The requirements for Release 1 of JWARS were defined previously in Section 1.3. The test sites that will participate in the OT&E of Release 1 are defined in the JWARS Installation Plan and in the JWARS Fielding Plan. Results of the operational testing of JWARS at the various test sites will be provided to an analysis group from the users, the test facilitator, and the OST who will analyze the CMF performance of JWARS. Additionally, the OST will conduct observations, surveys, and interviews to obtain information regarding JWARS suitability and survivability. The results from the analysis group combined with suitability and survivability data will provide the information needed for the OST to prepare an assessment of JWARS Release 1.

a. Configuration Description. See Annex D and JWARS ORD.

b. OT&E Objectives

Operational Effectiveness.

- Assess how well JWARS provides capabilities to conduct military operational assessments in a manner that helps to achieve users' analytic objectives in support of the Force Assessment applications defined in Appendix A of the JWARS ORD.

Operational Suitability.

- Assess the logistical supportability of the JWARS.
- Assess the human-systems integration of JWARS.
- Assess the degree of Y2K compliance by JWARS.

Operational Survivability.

- Assess JWARS security to ensure applications and data are protected as required.

c. Operational T&E Events, Scope of Testing, and Scenarios. The OST will assist test sites in the development of plans to test JWARS in Force Assessment applications. Also, the test sites will provide information to OST for OT&E planning and assessment. The SEP and EDP, developed by the OST, will provide more details on the test events. Paragraphs 4.3.1 c (1-10) also apply to paragraphs 4.3.2 c, 4.3.3 c, and 4.3.4 c, hence will not be repeated.

(1) Resources. The JWARS Office will provide Release 1 of the JWARS software. The users involved with the T&E will provide user test participants and facilities.

(2) Simulations. Not applicable (N/A).

(3) Personnel. Users who will conduct and / or support Force Assessment studies and other potential users of JWARS.

(4) Logistics Support. Logistics support, and operations and maintenance for the fielded version of JWARS will be provided by the JWARS Office and the future Configuration Management (CM) Administrator. The development contractor will provide needed support during testing.

(5) Documentation. The documentation supporting JWARS training, operation, and maintenance, including security documentation, will be provided with Release 1.

(6) Environment. Testing will take place in modeling and simulation (M&S) centers of the designated test sites.

(7) Interoperability. See requirements as specified in the JWARS ORD**.**

(8) Sources of Information. Results of DT&E, Beta testing, V&V, and continuous evaluation.

(9) Limitations. None.

(10) Scenarios. A scenario, in terms of the JWARS program, defines the overall context of analysis that JWARS must support. Each phase of JWARS development proceeds according to a scenario context that enlarges the functionality of the model. Release 1, the limited IOC version of JWARS, will examine a scenario comprehensive enough to address all JWARS requirements for Release 1 as specified in the ORD. The Mobility Requirements Study-2005 (MRS-05) was chosen as the study effort that will provide the background and military context for the operational testing of JWARS. The focus of the JWARS analysis will be the 2-MTW baseline from the MRS-05 scenario. Any data imbedded in code or algorithms within JWARS will be evaluated in conjunction with the V&V process. The JDS will facilitate the verification and validation of the input data sets needed to run and use JWARS.

4.3.2 Release 2. The operational testing of Release 2 will be of a version of JWARS that provides sufficient capabilities to be ready for use in meeting military campaign analysis needs as specified in the ORD. The Joint Staff / J8, the test sites, and OST will designate selected M&S test activities to be conducted. The type test activities conducted at a site will be consistent with the mission of supporting their Service or Command. Results of JWARS usage at these sites will be provided to an analysis group from the OST, the T&E facilitator, and the users who will analyze the CMF performance of JWARS. Additionally, the OST will conduct observations, surveys, and interviews to obtain information regarding JWARS suitability and survivability. The results from the analysis group combined with suitability and survivability data will provide the information needed for the OST to prepare an assessment of JWARS Release 2.

a. Configuration Description. See Annex D and JWARS ORD.

b. OT&E Objectives. The following are the evaluation objectives:

Operational Effectiveness.

- Assess how well JWARS provides users with a balanced warfare representation to include C4, ISR, and logistics and supports the Planning and Execution and Force Assessment applications.
- Assess the adequacy and availability of data to support modeling of friendly and enemy forces to include the use of operational test data to refine results.
- Assess the capability of the JWARS to replace legacy models TACWAR and MIDAS.

Operational Suitability.

- Assess the logistical supportability of JWARS.
- Assess the capability of the JWARS to provide the required level of security for sensitive information.
- Assess HSI.

- Assess the degree of Y2K compliance by JWARS.

Operational Survivability.

- Assess JWARS data backup and recovery procedures to ensure data integrity.
- Assess JWARS security to ensure applications and data are protected at the appropriate security level.

c. Operational T&E Events, Scope of Testing, and Scenarios. The operational testing of Release 2, which provides the primary source of data for the operational assessment, will be conducted during live operations at designated test sites. Users will exercise the areas of JWARS that supports Service or Command needs. The JWARS Office, J8 and the OST will coordinate with the Services to develop an overall test strategy for JWARS that has each test site exercising elements of Release 2. The type of M&S test activities conducted at a site will be consistent with the mission of supporting their Service or Command. This approach will ensure the Services and Commands have an opportunity to analyze and report on the adequacy of the M&S most directly affecting their operations. Elements of JWARS to be tested will include the new threads that have been added since last release and their interaction with threads from previous releases. Other elements to be tested include C4, ISR, logistics and usefulness in Planning and Execution, and Force Assessment applications. The test strategy shall also ensure that joint operations are tested at more than one location using data from participating Services. Each of the test sites will apply Release 2 using deterministic or stochastic processes as necessary when executing the simulation. Although it is anticipated that modeling of force assets will use design specifications or characteristics, testing will also include the use of operational test data sets, when appropriate, to refine results.

Results of JWARS usage at the test sites will be provided to an analysis group from the users, the test facilitator, and the OST who will analyze the CMF performance of JWARS. The OST will conduct observations, surveys, and interviews to obtain information for JWARS suitability and survivability. The suitability and survivability data will be collected during the operational testing and continuous evaluation of JWARS. Results from the analysis group, combined with the suitability and survivability data, will provide the information needed for the OST to prepare an assessment of JWARS Release 2 operational effectiveness, suitability, and survivability. The system evaluation and event design plans will contain the details of which Service and Command will execute which elements and identify the situations in which the operational test data sets will be used for simulation runs. The intent of the OT&E strategy is to minimize overall test and evaluation costs while providing sufficient data for a credible system assessment. The success of this effort will depend on close cooperation among the WIPT organizations. Paragraphs 4.3.1 c (1-10) apply here.

4.3.3 Release 3. The functionality incorporated into Release 3 provides added capability to Releases 1 and 2. The OT&E of Release 3 will follow an approach similar to the OT&E of Releases 1 and 2, except that, at this stage, the OST will prepare a system evaluation (vice an assessment) of JWARS.

a. Configuration Description. The tested configuration consists of the Release 3 functionality and applications with supporting software required for the users to apply JWARS to the M&S needs of the Service or command test site.

b. OT&E Objectives. The following evaluation objectives for Release 3 are:

Operational Effectiveness

- Assess the capability of JWARS to provide the users with a balanced warfare representation to include C4, ISR, and logistics, and supports the Planning and Execution application, Force Assessment application, System Effectiveness and Trade-off Analyses, and Concept and Doctrine Development
- Assess the adequacy and availability of data to support modeling of friendly and enemy forces to include the use of operational test data to refine results
- Assess the capability of JWARS to replace models CEM, THUNDER, ITEM and SUMMITS

Operational Suitability.

- Assess the logistical supportability of JWARS
- Assess the capability of JWARS to provide the required level of security for sensitive information
- Assess the impact of manpower, training, personnel, human factors engineering, and safety and health concerns
- Assess the degree of the Y2K compliance by JWARS

Operational Survivability.

- Assess JWARS data backup and recovery procedures to ensure data integrity
- Assess JWARS security to ensure applications and data are protected at the appropriate security level

c. Operational T&E Events, Scope of Testing, and Scenarios. The operational testing of Release 3, which provides the primary source of data for the operational evaluation, will be conducted during live operations at designated test sites. Users will exercise the areas of JWARS that supports Service or Command needs. The JWARS Office, J8 and the OST will coordinate with the Services to develop an overall test strategy for JWARS that has each test site exercising elements of Release 3. The type of M&S test activities conducted at a site will be consistent with the mission of supporting their Service or Command. This approach will ensure the Services and

Commands have an opportunity to analyze and report on the adequacy of the M&S most directly affecting their operations. Elements of JWARS to be tested will include the new threads that have been added since last release and their interaction with threads from previous releases. Other elements to be tested include C4, ISR, logistics and usefulness in Planning and Execution, and Force Assessment applications. The test strategy shall also ensure that joint operations are tested at more than one location using data from participating Services. Each of the test sites will apply Release 3 using deterministic or stochastic processes as necessary when executing the simulation. Although it is anticipated that modeling of force assets will use design specifications or characteristics, testing will also include the use of operational test data sets, when appropriate, to refine results.

Results of JWARS usage at the test sites will be provided to an analysis group from the users, the test facilitator, and the OST who will analyze the CMF performance of JWARS. The OST will conduct observations, surveys, and interviews to obtain information for JWARS suitability and survivability. The suitability and survivability data will be collected during the operational testing and continuous evaluation. The results from the analysis group, combined with the suitability and survivability data, will provide the information needed for the OST to prepare an evaluation of JWARS Release 3 operational effectiveness, suitability, and survivability. The system evaluation and event design plans will contain the details of which Service and Command will execute which elements and identify the situations in which the operational test data sets will be used for simulation runs. The intent of the OT&E strategy is to minimize overall test and evaluation costs while providing sufficient data for a credible system assessment. The success of this effort will depend on close cooperation among the WIPT organizations. Paragraphs 4.3.1 c (1-10) apply here.

5. TEST AND EVALUATION RESOURCE SUMMARY

5.1 Test Articles

Table 5.1 (at the end of the section) lists the major test events that have been planned for the JWARS DT&E and OT&E. Also included are the major test items and additional test support required from the Services.

5.2 Test Sites and Instrumentation

The tests will require government resources and government facilities i.e., OSD/PA&E, JCS/J8, USA/TRAC, USA (CAA), USN (N81), USAF (AFSAA), USMC (MCCDC), USTRANSCOM, USCENTCOM, USSOCOM, USPACOM, and USFK. All of the organizations involved in the testing will coordinate with the OST and with the JWARS Office to ensure that sufficient resources will be available at test time.

5.3 Test Support Equipment

The JWARS Office will provide a list of HW/SW requirements for T&E. Test plans for the operational tests and assessments will identify the necessary test support equipment; these plans will be developed by the OST in concert with the various testing sites.

5.4 Threat Representation

Threat may be identified as computer virus, software piracy, and computer hacker. The JWARS Security Test Plan will address these issues.

5.5 Operational Test Support

a. The responsibilities of the JWARS Office, the OST, and the government and contractor support personnel at individual test sites are set forth separately in a Memorandum of Agreement (MOA). A separate MOA is negotiated for each test. The MOA is a stand-alone document and its provisions are separate from but consistent with the responsibilities described in this test plan.

b. To conduct testing, the OST will require “participation” in and admission to various Service and CINC analysis centers. Participation (as defined here) is expected to take the form of passive data collection activities such as, observation of event activities and the gathering of event data and results. Surveys focusing on human systems integration and software usability will be administered to test participants as one method of data gathering for operational evaluation.

c. The JWARS Office will ensure that the JWARS model under test during OT&E will contain the necessary detail and functionality to carry out the set of assessments for the planned scenario and the envisioned applications as defined in the JWARS ORD. The OST will not need additional interfaces or object models to complete the test.

d. The OST will identify the necessary personnel, unit and material resources and the timing sequence of events for the operational tests as defined in the SEP and the EDP.

5.6 Simulations, Models and Test-beds

The JWARS development environment will have multiple test-beds. Each test-bed will consist of computer systems, database server, and operating system software; additional software may be required depending on level of classified material being utilized. The Software Test Plan (STP) and the Alpha Test Plan (ATP) will identify these components and will describe the specific applications in which they are to be used and the means of maintaining their configuration.

5.7 Specific Requirements and Documentation

Documentation and traceability is key to the development, assessment, and evaluation of JWARS. Documentation will be generated and made available on the JWARS Homepage, associated Subgroup User Pages, and other DoD electronic forums (UNCLASSIFIED and SIPRNET). User training, installation, and user manuals will be provided to Test Sites at Alpha and follow-on releases of JWARS.

Source Code as a form of documentation will be made available to the Test Sites on the SIPRNET at Alpha release and subsequent iterations. Prior to Iteration 5, availability will be as read-only files so as not to interfere with development. A “No Questions Asked” policy will be instituted for Iteration 4 only; i.e., users who receive source code from Iteration 4 will not be allowed to seek help from the JWARS Office, developers, or Help Desk until later. The JWARS Help Desk will be capable of handling questions on Source Code at Iterations 5 and thereafter. Training on Smalltalk Code will not be provided by the JWARS Office

The specific requirements for items such as unique mapping, charting, or geodesy products are provided by the JWARS Office / development contractor. JWARS shall, to the maximum extent possible, use DoD standard geo-spatial data, and be designed to accept commercially available maps and imagery data.

5.8 Test and Evaluation Funding Requirements

Funding for test events prior to OT&E will be on a voluntary basis for each test site and in accordance with the JWARS Fielding Plan. OT&E funding requirements will be coordinated and finalized after the Outline Test Plan estimates are completed by TEXCOM.

5.9 Manpower / Personnel Training

a. Government personnel include system administrators, database managers, analysts, etc. The Alpha test MOA for each site will identify the type and duration of training to be provided.

b. A test team manager (dedicated for the full test period of OT&E) is essential to the conduct of valid systems evaluation. For each operational test site, the test team will be headed by a Test Director. The remainder of the test team will be made up of personnel from each Service, subject matter experts, and associated agencies.

c. Key resources for the operational assessments will be determined by the OTAs for each site in accordance with directions from the WIPT and as defined in the SEP and the EDP.

d. Key resources for the DT&E test events will be determined by the JWARS office as defined in the developer's test plans, the software test plans, and the alpha test plans.

e. Selected members of the OST will require familiarization training with JWARS.

TABLE 5.1 JWARS System Test Resource Summary

Test Event	Iteration 1	Iteration 2	Iteration 3	Iteration 4	Iteration 5	Iteration 9	Iteration 12
Organizations Involved	CACI / GRCI, JWARS Office BMH/IMC	CACI / GRCI, JWARS Office BMH/IMC	CACI / GRCI, JWARS Office BMH/IMC, J8, OSD/PA&E USA/CAA, USAF/AFSAA, USMC/MCCD CUSN/N81, TRAC, USFK, USCENTCOM, TRANSCOM, USPACOM, USSOCOM	CACI / GRCI, JWARS Office BMH/IMC	CACI / GRCI, JWARS Office BMH/IMC, J8, OSD/PA&E, USA/CAA, USAF/AFSAA, USMC/MCCDC, USN/N81, TRAC, USFK, USCENTCOM, TRANSCOM, USPACOM, USSOCOM	CACI / GRCI, JWARS Office BMH/IMC, J8, OSD/PA&E, USA/CAA, USAF/AFSAA, USMC/MCCDC, USN/N81, TRAC, USFK, USCENTCOM, TRANSCOM, USPACOM, USSOCOM	CACI / GRCI, JWARS Office BMH/IMC, J8, OSD/PA&E, USA/CAA, USAF/AFSAA, USMC/MCCDC, USN/N81, TRAC, USFK, USCENTCOM, TRANSCOM, USPACOM, USSOCOM
JWARS Software	Iteration # 1	Iteration # 2	Iteration # 3 Release 0.5 (Alpha Test Version of JWARS)	Iteration # 4	Iteration # 5 Release 1 of JWARS Code (1st Operational Test version)	Iteration # 9 Release 2 of JWARS Code IOC Version	Iteration # 12 Release 3 of JWARS Code FOC Version
Support software	Oracle SQL Plus	Oracle SQL Plus	Oracle SQL Plus	Oracle SQL Plus	Oracle SQL Plus	Oracle SQL Plus	Oracle SQL Plus
JWARS Hardware	Sun Solaris Server; UNIX or NT Work Station	Sun Solaris Server; UNIX or NT Work Station	Sun Solaris Server; UNIX or NT Work Station	Sun Solaris Server and NT Work Station Required	Sun Solaris Server and NT Work Station Required	Sun Solaris Server and NT Work Station Required	Sun Solaris Server and NT Work Station Required
Support HW			Installation Readiness Report		Installation Readiness Report	Installation Readiness Report	Installation Readiness Report
Documentation	Software Test Plan	Software Test Plan	Alpha Test Plans, STP, Alpha Analyst Users Manual and Training Material, Task Partitioning Plan (TPP) ,	Software Test Plan	Operational Test Plans for Release 1, STP, System Evaluation Plan (SEP), Event Design Plan (EDP)	Operational Test Plans for Release 2, STP, SEP, EDP	Operational Test Plans for Release 3, STP, SEP, EDP
Test Site Locations	JWARS Office	JWARS Office	PA&E (SAC), J8, TRAC, CAA, AFSAA, MCCDC, N81, USCENTCOM, TRANSCOM, USFK, USPACOM, USSOCOM	JWARS Office	PA&E (SAC), J8, TRAC, CAA, AFSAA, MCCDC, N81, USCENTCOM, TRANSCOM, USFK, USPACOM, USSOCOM	PA&E (SAC), J8, TRAC, CAA, AFSAA, MCCDC, N81, USCENTCOM, TRANSCOM, USFK, USPACOM, USSOCOM	PA&E (SAC), J8, TRAC, CAA, AFSAA, MCCDC, N81, USCENTCOM, TRANSCOM, USFK, USPACOM, USSOCOM

No. of Test Events Per Site	**See: Test Event Plan**	**See: Event Design Plan**	**See: Event Design Plan**	**See: Event Design Plan**
Duration of Test	**See: Test Event Plan**	**See: Event Design Plan**	**See: Event Design Plan**	**See: Event Design Plan**

ANNEX A
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ANNEX B
ACRONYMS AND ABBREVIATION

ADP	Automated Data Processing
AFOTEC	Air Force Operational Test & Evaluation Center
AFSAA	Air Force Studies and Analysis Agency
AFTED	Air Force Test and Evaluation Directorate
AI	Additional Issues
AT	Acceptance Test or Alpha Test
ATO	Air Tasking Order
BCM	Baseline Correlation Matrix
BDA	Battle Damage Assessment
BMH-IMC (IMC)	BMH Associates, Inc. (BMH)-Innovative Management Concepts, Inc.
BSE	Battle Space Entity
BT	Beta Testing
BWR	Balanced Warfare Representation
C4	Command, Control, Communications and Computers
C4ISR	C4, Intelligence, Surveillance and Reconnaissance
CAA	Concepts Analysis Agency
CCB	Configuration Control Board
CDD	Concept and Doctrine Development
CE	Continuous Evaluation
CEM	Concepts Evaluation Model
CINC	Commander-in-Chief
CM	Configuration Management
CMA	Configuration Management Authority
CMF	Critical Mission Functions
CMFA	Critical Mission Function Analysis
CMIDB	Configuration Management Item Data Base
COA	Course of Action
COE	Common Operating Environment
COI	Critical Operational Issue
COIC	Critical Operational Issues and Criteria
CONOPS	Concept of Operation
COOP	Continuity of Operations
COTS	Commercial Off-The-Shelf
CSC	Critical System Characteristics

CTP	Critical Technical Parameters
DAA	Designated Accreditation Authority
DBMS	Data Base Management System
DCA	Defensive Counter Air
DIA	Defense Intelligence Agency
DII	Defense Information Infrastructure
DII-COE	Defense Information Infrastructure-Common Operating Environment
DMSO	Defense Modeling and Simulation Office
DoD	Department of Defense
DoDD	Department of Defense Directive
DOT&E	Director, Operational Test and Evaluation
DT	Developmental Test
DT&E	Developmental Test and Evaluation
DUSA (OR)	Deputy Under-Secretary Army (Operations Research)
EDP	Event Design Plan
EXCOM	Executive Committee
FA	Force Assessment
FOC	Full Operational capability
GOTS	Government-Off-The-Shelf
GUI	Graphical User Interface
HCI	Human Computer Interface
HLA	High Level Architecture
HSI	Human-System Integration
IAW	In Accordance With
IDA	Institute for Defense Analyses
IDB	Item Data Base
IOC	Initial Operational Capability
ILS	Integrated Logistics Support
IPB	Intelligence Preparation of the Battlefield
IPT	Integrated Product Team
ISR	Intelligence Surveillance and Reconnaissance
IT	Integration Test
ITE	Integrated Test and Evaluation or Intelligence Threat Estimate
ITEM	Integrated Theater Evaluation Model
ITPS	Integrated Test Program Schedule
JAD	Joint Application Design

JAMIP	Joint Analytic Model Improvement Program
JCCB	JWARS Configuration Control Board
JDS	Joint Data Support
JIEO	Joint Interoperability Evaluation Office
JITC	Joint Interoperability Test Center
JS	Joint Staff
JSIMS	Joint Simulation System
JTF	Joint Task force
JV-2010	Joint Vision 2010
JWARS	Joint Warfare System
JWARG	Joint Warfare Refinement Group
KPP	Key Performance Parameters
LIA	Lead Integrating Agency
M&S	Modeling and Simulation
MCCDC	Marine Corps Combat Developments Command
MCOTEA	Marine Corps Operational Test and Evaluation Activity
MDA	Milestone Decision Authority
MIDAS	Model for Inter-theater Deployment by Air and Sea
MOE	Measures of Effectiveness
MOP	Measures of Performance
MRS-05	Mobility Requirements Study-2005
MTW	Major Theater War
N81	Deputy Chief of Naval Operations, Assessments Div
N91	Director of Navy Test & Evaluation & Technology
NSM	Network System Management
OA	Operational Assessment
OCA	Offensive Counter Air
OEC	Operational Evaluation Command
OI	Operational Issues
OO	Object Oriented
OPTEC	Operational Test and Evaluation Command
OPTEVFOR	Operational Test and Evaluation Force
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
OST	OPTEC System Team
OT	Operational Test
OTA	Operational Test Activity
OT&E	Operational Test and Evaluation

PA&E (SAC)	Program Analysis & Evaluation (Simulation Analysis Center)
PM	Program Manager
PMP	Program Management Plan
POC	Point of Contact
QA	Quality Assurance
R&M	Reliability and Maintainability
RTI	Runtime Infrastructure
RTM	Requirements Traceability Matrix
SC	System Concepts
SDP	System Development Plan or Software Development Plan
SDP	Software Development Process
SEAD	Suppression of Enemy Air Defenses
SEP	System Evaluation Plan
SME	Subject Matter Expert
SOF	Special Operations Forces
SP	Software Priority
SPMP	Software Project Management Plan
SR	Software Requirements
SRS	Software Requirements Specification
ST	System Test
STD	Software Test Design
STEP	Security Test and Evaluation Program or Software Test and Evaluation Plan
STP	Software Test Plan
STR	Software Test Report
STRAP	System Training Plan
SUMMITS	Scenario Unrestricted Mobility Model for Intra-theater Simulation
SUTE	System Undergoing Test and Evaluation
TACWAR	Tactical Warfare (model)
TBD	To Be Determined
TC	Test Coordinator
TD	Test Director
TEP	Test and Evaluation Plan
TRAC-FLVN	TRADOC Analysis Center-Ft. Leavenworth
TRADOC	Training and Doctrine Command
TRR	Test Readiness Reviews
UJTL	Universal Joint Task List

UT	Unit Test
V&V	Verification and Validation
VV&C	Verification, Validation and Certification (of Data)
WIPT	Working Integrated Product Team
WMD	Weapons of Mass Destruction
Y2K	Year 2000

ANNEX C

POINTS OF CONTACT

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ANNEX D
SYSTEM DESCRIPTION INFORMATION

1. JWARS Simulation Functions. The Universal Joint Task List (UJTL) and the threads provided at Appendix B and C of the JWARS ORD, represents the prioritized functionality required in a joint theater warfare simulation. Prioritization is based on the importance of some aspect of the task to the simulation and is unconstrained by cost or technical feasibility.

2. Key JWARS Features.

- **Classification and Releasability.** JWARS software shall be capable of conducting analysis at both the SECRET (collateral) level and at higher levels of classification. All JWARS data, code, and output must reflect the appropriate level of classification to facilitate transfer across classification levels. All output of JWARS shall reflect the level of classification to facilitate requests for releasability. The design and implementation of JWARS shall not preclude replacement of classified data, objects, and algorithms with unclassified data, objects, and algorithms.
- **Closed Form.** JWARS applications will be state-of-the-art, closed form, analyses of joint military operations that are based on C4ISR processes.
- **Deterministic and Stochastic Methodology.** These methodologies depict different approaches to the variable aspects of warfare that are being modeled. The user shall be able to choose from a single value, from common probability distributions, or from user provided distributions for input data. Post-processing tools shall facilitate examination of distributions and correlations associated with simulation results.
- **Ease of Use.** Ease of use is viewed in two respects: training required and automated decision support requirements. Training is used to attain initial and full productivity levels to load input data, execute model runs, and extract output data for analysis. An analyst with OPM operations research/systems analysis accreditation shall attain an initial productivity level with two weeks of training, and a full capability with an additional six months of training. JWARS shall have also a selectable automated decision making capability for operational and tactical level decisions.
- **High Level Architecture.** JWARS will conform to the High Level Architecture (HLA) for simulations being defined under the leadership of the Defense Modeling and Simulation Office (DMSO). That architecture will be a common technical framework that enables simulations in diverse functional areas but with comparable levels of resolution to federate with one another (i.e., to execute in parallel and inter-operate). However, JWARS is not intended to be interactive, support real time mission execution, or to be linked directly to real-world C4ISR systems.

- **Maintainability**. Maintainability is defined as the ability to provide rapid and cost-effective input data and run time diagnostics. The software shall provide preprocessor functions of type checking, range checking, and context checking, with the capability to identify the source of and facilitate the correction of errors. During run time the software will identify the type and probable source of errors.
- **Multiple levels of resolution.** Multiple levels of resolution provide the user the capability to select varying levels of aggregation.
- **Portability.** Portability represents the ability to move JWARS between two different supported hardware platforms. At Release 2, data sets shall require no modification and total systems software shall require less than a 2% change to the lines of executable code to establish JWARS on a different supported hardware platform. At Release 3, no system software modifications shall be required to move JWARS to a different supported hardware platform.
- **Reliability.** The ability of JWARS to perform a simulation under stated conditions for a specified period of time. At each release the software shall produce a 98% probability of completing a simulation run after initiation when there are no operator-input errors.
- **Repeatability.** The ability of JWARS to reproduce results of a single simulation. At each release the same initial conditions (to include random number seeds for stochastic replications) shall provide the same output on the same hardware platform.
- **Run Control.** Run control represents the ability to monitor and modify the execution of the JWARS simulation. At each release the user shall be able to interrupt JWARS, modify data, and start excursions from the same point. In addition, the user shall be able to dictate a rolling checkpoint that allows periodic capture of "state-of-the-system" at user-defined intervals or events and permit restart, with modifications of data, at any of these points.
- **Run Time.** The following run time requirements must be met using both deterministic and stochastic methodologies and on hardware platforms constrained by the mobility requirements identified in the ORD.

  At Release 1:
  - ✓ execute a 100-day MTW campaign faster than a 1000:1 speed (approximately 2.5 hours).

  At Release 2:
  - ✓ execute a 100-day MTW campaign faster than a 1000:1 speed (approximately 2.5 hours).

  At Release 3:
  - ✓ execute a 100-day MTW campaign faster than a 500:1 speed (approximately 5.0 hours) for System Effectiveness and Trade-off Analysis and Concept and Doctrine Development analysis requirements
  - ✓ execute a 100-day MTW campaign faster than a 1000:1 speed (approximately 2.5 hours) for Planning and Execution and Force Assessment applications.

- **System Integrity.** Protecting the hardware system, software code, and data integrity from alteration or compromise.
- **Tailorability.** JWARS objects and architecture that are modifiable produce the operational flexibility needed by JWARS.
- **Traceability**. Traceability represents the ability to identify why a certain result was obtained from JWARS. It will facilitate identification of cause-and-effect relationships needed to explain analysis. In addition, JWARS shall provide a means to track the sources of data values used. If user changes are made for a particular application, JWARS shall track the changes from baseline version to analytical excursions and mark output accordingly. JWARS shall also allow a global comparison of input data sets indicating, when queried, which values were changed from certified input data to excursion values.
- **Utility.** The utility of JWARS includes measures of study execution, multiple levels of resolution, deterministic and stochastic methodology, and run time.
- **Verification and Validation.** JWARS shall demonstrate and enable the correct representation of doctrine, system performance, the environment, and balance among joint warfare functions for U.S. forces, Allies, coalition partners and potential adversaries.

ANNEX E
OPERATIONAL ISSUES

E.1 Critical Operational Issue (COI) 1. Mission performance. *Does JWARS (Joint Warfare System) support the ORD-defined modeling and simulation needs of the OSD, the Joint Staff, the Services, the CINCs, and others to support planning and execution, force assessment, system effectiveness and trade-off analysis, and concept and doctrine development?*

E.1.1 COI 1 Scope.

a. The end-users of JWARS will be analysts in the analysis organizations of the Office of the Secretary of Defense (OSD), Joint Staff, Services, CINCs, Joint Task Force (JTF) Commanders/Staff, selected other Department of Defense (DoD) organizations, and industry.

b. JWARS shall operate using required and valid input data received over the intended interfaces. Such data include, but are not limited to, time-phased force deployment data (TPFDD), Joint Data Support (JDS) supplied data, unit status reports (USRs), environmental data, and system performance parameters from operational testing.

c. JWARS shall satisfy the accuracy and timeliness conditions described in Appendix A of the ORD.

E.1.2 COI 1 Criteria.

a. Planning and Execution: JWARS shall support development of one or more courses of action and risk assessments for U.S. Forces, Allies, coalition partners, and potential adversaries in multiple Smaller Scale Contingencies (SSCs) or Major Theaters of War (MTWs).

b. Force Assessment: JWARS shall support identifying those forces required to execute the National Military Strategy (NMS).

c. System Effectiveness and Trade-off Analysis: JWARS shall support capability assessments on the performance of major systems and sub-systems (e.g., platform, software, weapon, and sensor) within or among Service assets in campaign-level context.

d. Concept and Doctrine Development: JWARS shall support evaluation of current and proposed operational concepts and force doctrine by assessing their impact within the context of a theater campaign.

E.1.3 COI 1 Rationale.

a. The mission of JWARS is to meet user analytical requirements by developing an integrated, state-of-the-art campaign-level model of Joint Warfare.

b. JWARS shall provide military campaign analysts with a significantly enhanced ability to realistically model both current and future warfare. JWARS shall provide balanced warfare representation to include C4, ISR, and logistics. JWARS is intended to correct shortcomings in the analytic representations of balanced joint operations; the synergy across functional warfare areas to include C4 (command, control, communications, and computers), ISR (intelligence, surveillance, and reconnaissance), and logistics; and an appropriate representation of current and future U.S., allied, coalition, and threat capabilities.

E.2 COI 2. Business Process Support. *Does JWARS have the capability to support user-unique approaches to the preparation and execution of simulations?*

E.2.1 COI 2 Scope. See paragraph E.1.1. The requirements for business process support are described for each increment of JWARS within the JWARS ORD. The detailed implementation of each increment is approved by the Joint Analytic Model Improvement Program (JAMIP) Steering Committee.

E.2.2 COI 2 Criteria.

a. JWARS shall execute a 100-day MTW campaign faster than a 1000:1 speed (approximately 2.5 hours) for Planning and Execution and Force Assessment applications.

b. JWARS shall execute a 100-day MTW campaign faster than a 500:1 speed (approximately 5 hours) for System Effectiveness and Trade-off Analysis and Concept and Doctrine Development applications.

c. JWARS shall uniquely represent joint functions and processes and component warfare operations, be based in joint doctrine, be capable of representing future warfare, and aid in force structure, acquisition and theater CINC course-of-action analyses.

d. JWARS shall be capable of replacing legacy models such as: the Tactical Warfare Model (TACWAR), the Model for Inter-theater Deployment by Air and Sea

(MIDAS), the Concepts Evaluation Model (CEM), THUNDER (the Air Force's campaign-level model), the Integrated Theater Evaluation Model (ITEM), and the Scenario Unrestricted Mobility Model for Intra-Theater Simulation (SUMMITS).

e. JWARS shall achieve the same output on the same hardware given the same initial conditions (demonstrate repeatability).

f. JWARS shall provide the user the capability to select varying levels of resolution, balanced across all warfare functions. Release 1 and 2 shall have a single level of resolution.

E.2.3 COI 2 Rationale. See paragraph E.1.3.

E.3 COI 3. Human-Systems Integration (HSI). *Can typical user personnel that are trained to use, operate, maintain, and supervise modeling and simulation operations perform these duties in a satisfactory manner using JWARS?*

E.3.1 COI 3 Scope.

a. HSI is primarily concerned with two matters: (1) the sufficiency of JWARS training and documentation to satisfy user needs and (2) the usability and usefulness of JWARS to allow its military campaign analysts to perform their tasks efficiently.

b. HSI also considers the adequacy of on-line documentation and help features, as well as other help features that may be provided, to assist users with problems.

E.3.2 COI 3 Criteria.

a. Eighty (80) percent of the analysts who have received the intended JWARS training and documentation in the Office of the Secretary of Defense (OSD), the Joint Staff, the Services, the CINCs, and overall find them satisfactory.

b. Eighty (80) percent of the analysts who have used JWARS to perform tasks in the Office of the Secretary of Defense (OSD), the Joint Staff, the Services, the CINCs, and overall find JWARS satisfactory in terms of usability and usefulness.

c. The training, documentation, usability, and usefulness of JWARS shall enable JWARS to achieve the criteria for COI 1 and 2.

d. For crisis action planning, the time required for preparation, execution, and analysis shall be no more than 24 hours when a scenario data base exists or no more than 4 days when no scenario data base exists.

e. For deliberate planning, the time required for preparation (exclusive of data collection and validation), execution, and analysis shall be no more than 14 days for a baseline study and no more than 24 hours for an excursion.

E.3.3 COI 3 Rationale.

a. The software features, training, documentation, and resources for obtaining help (if needed) that are provided with JWARS should enable typical end-user analysts, administrators, and maintainers to effectively operate, manage, and maintain JWARS in their operational environment.

b. JWARS should satisfy the intended mission needs without undue difficulty.

E.4 Additional Issue (AI) 1.[3] Database Management. *Are there processes and procedures in place to provide the data for JWARS to operate as required?*

E.4.1 AI 1 Scope.

a. See paragraph E.1.1.b.

b. Since JWARS shall include features to create a trace or log file to aid in error diagnostics and to safeguard data processed by the simulation applications from modification by execution code, these features are considered part of JWARS database management processes.

c. For JWARS, database management includes any network/system management features or provisions required for JWARS to receive and process data as required for accomplishing its simulations in support of military campaign analysts.

E.4.2 AI 1 Rationale.

a. JWARS cannot function as required without complete, accurate, valid, and timely data for the simulations required to support military campaign analysis tasks.

b. JWARS will not operate as required without sufficient processes and procedures to ensure that data is provided to JWARS.

E.5 AI 2. Logistics and Maintenance. *Is the integrated support planned for JWARS sufficient to sustain it for its foreseeable length of service?*

[3] AIs are determined by an Operational Test Activity (OTA) in order to ensure an adequately comprehensive operational evaluation for the Milestone Decision Authority (MDA). OPTEC does not determine criteria for AI. The intent of AI is to identify information that the MDA will likely want to consider before deciding to field a system.

E.5.1 AI 2 Scope.

a. To port JWARS between two different supported hardware platforms, JWARS data sets shall require no modification, and total systems software shall require less than 2% modification to the lines of executable code.

b. To facilitate JWARS over the long term, JWARS shall comply with the relevant DoD standards for data, Defense Information Infrastructure Common Operating Environment (DII COE), and Year 2000 compliance.

c. Support planning for JWARS should cover configuration management, correction procedures for software problems and documentation discrepancies, post-deployment software support, infrastructure, maintenance provisions, survey processes, and fielding procedures.

E.5.2 AI 2 Rationale.

a. JWARS will not be able to operate as intended without sufficient computing power, data storage, and network connectivity.

b. While JWARS continues development, the JWARS Office will have to ensure that the software problems are corrected, users receive the technical assistance they may require, and that the appropriate infrastructure is on hand upon which to install the interim releases.

E.6 AI 3. Security. *Does the use of JWARS in its intended operational environment satisfy applicable security requirements?*

E.6.1 AI 3 Scope.

a. Security features include those in software, hardware, procedures, and other implementation techniques.

b. Security includes communications security (COMSEC), operational security (OPSEC), information security (INFOSEC), and physical security (PHYSEC).

c. Security covers continuity of operations (COOP) concerns and information assurance provisions.

d. At each release JWARS software shall be capable of conducting analysis at both the SECRET (collateral) level and at higher levels of classification. All JWARS data, code, and output must reflect the appropriate level of classification to facilitate transfer

across classification levels. All output of JWARS shall reflect the level of classification to facilitate requests for releasability.

e. At each release the design and implementation of JWARS shall not preclude replacement of classified data, objects, and algorithms with unclassified data, objects, and algorithms.

E.6.2 AI 3 Rationale.

a. Several provisions for the security of JWARS are not directly under the control of the JWARS office. Nevertheless, JWARS needs to be designed and implemented so security risks associated with its fielding and use are at an acceptable level as determined by the Designated Accreditation Authority. Furthermore, decision-makers for the fielding of JWARS need to be informed about how security risks have been addressed.

b. JWARS is not a combat system. Hence, discussion of a system-specific, Defense Intelligence Agency (DIA)-validated threat does not apply. However, a generalized automated data processing (ADP) security threat does exist from unauthorized intrusion, insertion of viruses, and theft or manipulation of data contained in files. An ADP security plan for the JWARS simulation still needs to be submitted by the program manager that addresses user security levels, and the requirement to control access to the source code and data files.

ANNEX F
CRITICAL TECHNICAL PARAMETERS

TABLE F-1. JWARS CRITICAL PERFORMANCE PARAMETERS

ORD Section	Test Event / Assessment	JWARS Critical Performance Parameter	Location	Decision Support	Status
4.b.(3)(d)(1)	*User Test / Operational Assessment*	*At Release 2 JWARS shall be able to execute a 100-day MTW campaign faster than a 1000:1 speed (approximately 2.5 hours).*	*Test Sites*		
4.b.(1)(a)	*User Test / Operational Assessment*	*JWARS shall allow an analyst to identify the cause-and-effect relationships needed to explain analysis.*	*Test Sites*		
4.b.(5)	*User Test / Operational Assessment*	*Software shall provide a 98% probability of completing a simulation run after initiation when there are no operator input errors.*	*Test Sites*		
4.b.(9)	*User Test / Operational Assessment*	*Data sets shall require no modification and total systems software shall require less than 2% modification to the lines of executable code to establish JWARS on a different supported hardware platform.*	*Test Sites*		
7.b	*User Test / Operational Assessment*	*Release 2 shall occur when at least one JWARS operational site is capable of performing Planning and Execution studies and at least one JWARS operational site is capable of performing Force Assessment studies.*	*Test Sites*		
4.b.(1)(b)	*User Test / Operational Assessment*	*JWARS shall also allow a global comparison of input data sets indicating, when queried, which values are changed from certified input data to excursion values.*	*Test Sites*		
4.b.(2)	*User Test / Operational Assessment*	*Balance shall be maintained by equitable representation of joint warfare functions, consistent with their impact on theater warfare operations.*	*Test Sites*		
4.b.(3)(a)(1)	*User Test / Operational Assessment*	*By Release2, JWARS shall provide balanced warfare representation to include C4, ISR, and logistics and be capable of performing the Planning and Execution application and the Force Assessment application described at Appendix A of*	*Test Sites*		

ORD Section	Test Event / Assessment	JWARS Critical Performance Parameter	Location	Decision Support	Status
		ORD.			
4.b.(3)(a)(1)	*User Test / Operational Assessment*	*By Release2, JWARS shall be capable of replacing the legacy campaign models TACWAR and MIDAS.*	*Test Sites*		
4.b.(3)(c)(1)	*User Test / Operational Assessment*	*At Release 2 a single level of resolution, balanced across all warfare functions, shall be available (see Run Time at 4b(3)(d)).*	*Test Sites*		

ANNEX G
GLOSSARY

Note: The definitions in this glossary are limited to those in this TEP which individuals may not know, if they are not familiar with military campaign analysis, formal test and evaluation, and verification and validation procedures.

Acceptance test A type of system testing whose purpose is to acknowledge that delivered software meets expectations and fulfills contractual obligations.

Accreditation Certification that a model is acceptable for use for a specific type(s) of application(s). Accreditation is approval by management—that a model is adequate for its intended use.

Accuracy Freedom from mistake or error: correctness; the degree of conformity of a measure to a standard or true value: exactness

Additional issue (AI) An AI is an issue identified by an Operational Test Activity (OTA), in addition to the COIs, that the OTAs will collect data to address. An OTA identifies AIs to ensure that OT&E is sufficiently comprehensive. An AI has no pass/fail criterion.

Aggregation The collecting of units, parts, or elements into a mass or whole; a group, body, or mass composed of many distinct parts.

Algorithm A mathematical expression of some operation.

Algorithm correctness Does the algorithm accurately represent the modeled operation.

Alpha test Testing of partial software developments performed by a relatively small number of users or potential users of the software development. The organization performing the testing does not normally have a primary responsibility for testing (i.e., a test organization). Purpose is to provide early feedback to the software developer by the future users. Testing structured to take advantage of users strengths and characteristics.

Analytic modeling A collection of interconnected algorithms that represent a collection of related operations.

Assessment The act of assessing or determining the importance, size or value of something.

Balanced warfare representation A model has balanced warfare representation if the level of detail and the level of resolution across all warfare functions and service entities are handled at approximately the same level; i.e., to be equal to or proportionate to. In JWARS, balance shall be maintained by equitable representation of joint warfare functions, consistent with their impact on theater warfare operations, and within the context of the functionality described in Appendix C of the JWARS ORD.

Beta test Informal testing of software development releases performed by analytical organizations that are users or potential users of the code being tested. Testing provides users the opportunity to become familiar with the software, to informally test areas of particular interest to them within the software design, and to make recommendations to the developer for future changes.

Business Process Support Methods and procedures employed by JWARS to support user-unique approaches to the preparation and execution of campaign-level simulations?

Campaign analysis A type of analysis involved with assessing the outcome of a conflict between two opposing forces at a campaign level. It includes all aspects of combat, such as land warfare, air-to-air combat, command and communications, etc. Typically the "wars" last from weeks to years, although the analysis is usually focused on a more limited period of time ranging from several days to months.

CEM *Concepts Evaluation Model***.** A campaign level model used primarily by the U.S. Army / CAA.

Concept of operations A statement, in broad outline, of a commander's assumptions or intent with regard to an operation or series of operations.

Condition An experimental variable associated with an observation that may be used to analyze variations within system performance.

Configuration Management (CM) CM is a process of managing software modifications

Configuration Management Administrator The person or group assigned responsibility for conducting CM

Continuity of Operations (COOP) Ability to continue to operate a system by restoring the system from a non-operational state using backup data.

Continuous Evaluation (CE) -- CE is the operational test and evaluation (OT&E) process, which includes all activities of observation, planning, and reporting conducted by evaluators over the entire life of a system. CE should begin as soon as possible during the acquisition cycle. By early involvement and with coordination with stakeholder agencies, evaluators attempt to identify and work to mitigate system development and operational testing risks. CE can provide input to assessments based upon developmental events and testing, with or without separate operational testing.

Course of Action (COA) A COA represents the plan and the process that a military commander would exercise in a specific military operations (i.e., the scheme adopted to accomplish a job or mission).

Critical Mission Function (CMF) A CMF is a function performed by an automated information system (AIS). A CMF provides one or more key informational products that its users can directly use in accomplishing critical tasks for the mission needs identified for the AIS. For operational testing, CMFs are

sampled to collect evidence of satisfactory mission performance and business process support over a realistic range of operational conditions. The CMFs addressed by operational testing may vary from release to release. This is to ensure that the key performance requirements associated with each release are well covered by OT. Some CMFs may be repeated for all operational testing events as a means of regression testing. Since CMFs are used to plan sampling for operational testing, the evaluator will consult with members of the system's T&E planning body regarding the CMFs to be targeted. The selection process for which CMFs will be subject to operational testing should be tempered by considerations of software risk such as code complexity and preceding test results.

Critical Operational Issue (COI) A COI is a key operational effectiveness or operational suitability issue that must be examined in operational test and evaluation to determine the system's capability to perform its mission. Typically phrased as a question that must be answered in order to properly evaluate operational effectiveness. If a COI is answered favorably, indicates that a system will be effective, suitable, or survivable. If a COI is answered negatively, there is a significant likelihood that the system will not be acquired for fielding. COIs are approved by those who have approval authority over requirements. Each COI should be clear in terms of scope, rationale, and criteria. (See Annex E for the COIs to be used in the Test and Evaluation of JWARS).

Critical System Characteristic (CSC) A CSC is a unique support concept resulting in special test and analysis requirements. CSC examples include post deployment software support; hardness against nuclear effects; resistance to countermeasures; development of new threat simulation, simulators, or targets. Special test and analysis requirement examples include parallel test systems, data for testing, and multilevel security.

Critical Technical Parameter (CTP) CTPs are identified by those who have approval over the requirements for a system as essential levels of performance. CTPs include software maturity and performance measures that have been evaluated or will be evaluated during the remaining phases of developmental testing. CTPs are derived from the ORD, critical system characteristics and technical performance measures and should be included the program baseline. CTPs may include functional area models for data and applicable standards.

Data Authentication Group (DAG) A DAG is a Government committee with at least one representative from the stakeholder developer, developmental test and evaluation (DT&E), functional proponent, and operational test activity (OTA) communities. A DAG reviews operational testing data to determine if the data has been accurately and completely recorded, and is valid for the intended operational test and evaluation measures. Anomalies identified by the DAG will be investigated by the OTA. The DAG may recommend to evaluator when data should not be included in the record database for operational test and evaluation. The OTA representative will chair the DAG. A DAG produces records of its deliberations that may be subject to later audit or legal review. A DAG attempts to achieve consensus, but, when that proves impractical, minority opinions and the majority's rebuttal must be included in the DAG records.

Data integrity The ability to protect the data from unintended changes.

Defense Information Infrastructure (DII) - Common Operating Environment (COE) The Defense Information Infrastructure Common Operating Environment (DII - COE) provides a set of integrated support services for mission area application software, and a corresponding software development environment. The DII COE provides architecture principles, guidelines, and methodologies that assist in the development of mission application software by capitalizing on the infrastructure support service.

Deterministic and stochastic methodology Deterministic models use expected value calculations to represent probability events. The result is a single outcome for each model run. Stochastic models use random numbers to define probabilistic events and (with different initial seeds) will usually produce different results for different runs, thus requiring several repetitions to obtain usable answers.

Development contractor The contractors developing the JWARS software.

Developmental Test and Evaluation (DT&E) An evaluation to verify the status of development progress; to verify that design risks have been minimized; to substantiate achievement of contract technical performance; and be used to certify readiness for dedicated operational test.

Dominant maneuver A term used in JV2010 to represent the multidimensional application of information, engagement, and mobility capabilities to position and employ widely dispersed joint forces to accomplish the assigned operational tasks.

Effectiveness (or operational effectiveness) Effectiveness is the capability of a system to perform in a manner that satisfies the mission needs for which the system was developed.

Emerging operational concepts Operational concepts that reflect the incorporation of new systems.

Evaluator (independent operational evaluator) An evaluator is an individual held responsible by an operational test activity (OTA) for planning, monitoring, executing, analyzing, and reporting the operational test and evaluation (OTE) of a system in an official evaluation report. An evaluator may use all appropriate sources of data in the OTE. The evaluator will report on the quality of all testing conducted, as appropriate.

Event Design Plan (EDP) The EDP documents for decision-makers the event design, supporting methodology, and analytic details required for a specific event. The primary objective of the EDP is to "paint a picture of the event" and to ensure that sufficient information is provided so that all participating agencies have a clear description of the event.

Focused logistics A term used in Joint Vision 2010 to represent the fusion of information, logistics, and transportation technologies to provide rapid crisis response and deliver tailored logistics packages directly at the strategic, operational, and tactical level of operations.

Force assessment The process of determining importance of or the value of stated force capabilities and how they match up with aggressor force capabilities

Full dimensional protection A term used in Joint Vision 2010 to represent the multi-layered offensive and defensive capability to protect our forces and facilities at all levels from adversary attacks while maintaining freedom of action during deployment, maneuver and engagement.

Full operational capability The final end-state operating capacity that a system development is focused on.

High Level Architecture (HLA) The HLA provides the specification of a common technical architecture for use across all classes of simulations in the DoD. That architecture will be a common technical framework that enables simulations in diverse functional areas but with comparable levels of resolution to federate with one another (i.e., to execute in parallel and inter-operate). It provides the structural basis for simulation interoperability.

Human-Computer Interface (HCI) The hardware and software allowing information exchange between the user and the computer.

Human-System Integration (HSI) The usability, usefulness, training, documentation, and help associated with a computer simulation.

Infrastructure Infrastructure is a generic term for items that are required for a system to perform as intended, but not delivered with the system or under the direct control of the developer. An example of an automated information system (AIS) infrastructure might include a wide area network (WAN), a local area network (LAN), computer hardware, and facilities.

Insertion operations The action of inserting troops behind enemy lines, often as part of a major attack.

Instrumentation The application of instruments for observation, measurement or control.

Integration Test A term that refers to informal tests that developers on different development teams conduct to make their code work together.

ITEM *Integrated Theater Evaluation Model*. A theater level campaign model used mainly by the U.S. Navy

Interoperability The capability of one model or simulation to translate information from another and to react to that information without manual intervention.

Inter-theater Actions or movements between theaters of operation.

Intra-theater Actions or movements within a theater of operations.

Iteration The process of completing a set of specified commands, procedures, or operations. For JWARS, an iteration is one of twelve planned development steps that builds increasing functionality into JWARS by adding development threads, or software development units of work.

Joint Task Force A force composed of assigned or attached elements from two or more of the Services.

Joint Vision 2010 The conceptual template for how the US military will channel its people and leverage technological opportunities to achieve new levels of effectiveness in joint warfighting.

Lead operational test activity Leader of the operational test organizations conducting a joint system test.

Legacy models Models currently in use (that JWARS is being designed to replace).

Maintainability For the JWARS program, maintainability is defined as the ability to provide rapid and cost-effective input data and run time diagnostics. The software shall provide preprocessor functions of type checking, range checking, and context checking, with the capability to identify the source of and facilitate the correction of errors. During run time the software will identify the type and probable source of errors.

Major Theater of War (MTW) A large military conflict (e.g., Gulf War).

Measure of Effectiveness (MOE) (1) A MOE is a high-level quantitative or qualitative, objective measure that directly reflects an essential aspect of a system's operational effectiveness, suitability, or survivability. A MOE may be supported by multiple "complementary" or "supplemental" measures of performance. (2) A MOE is a calculated value from a military campaign analysis simulation that an analyst will consider in answering study issues. (3) A MOE is a measure obtained through operational test data that addresses one or more criteria associated with a critical operational issue. In this context, MOEs may apply to the evaluation domains of suitability and survivability, as well as effectiveness.

Measure of Performance (MOP) A MOP is a quantitative or qualitative, objective measure that does not lead directly to a conclusion about a system's operational effectiveness, suitability, or survivability. A MOP may be complementary or supplemental. It is a measure of system capabilities or characteristics intended for detailed analysis regarding system performance or for fault isolation. A MOP indicates the degree to which a capability or characteristic performs or meets the requirement under specific conditions.

MIDAS *Model for Inter-theater Deployment by Air and Sea*. Used mainly by Joint Staff and OSD (PA&E)

Multi-sided The representation of elements from more than one side.

Network System Management (NSM) The management of the computer network used to execute JWARS.

Object-Oriented (OO) design A method of implementation in which programs are organized as cooperative collections of objects, each of which represents an instance of some class, and whose classes are all members of a hierarchy of classes united via inheritance relationships.

Operational Assessment An evaluation of the operational adequacy of a partial system; contains preliminary OST recommendations

Operational Evaluation An evaluation of the operational adequacy of a complete system; contains final OST recommendations

Operational Test The operational testing of software development directed by OTAs in collaboration with the analytical organizations that are users or potential users of the software being tested. Testing also provides users

the opportunity to examine areas of particular interest to them within the software for the purpose of making recommendations to the developer for future changes.

Operational Test Activity (OTA) An independent organization in one of the four military components that reports operational test and evaluation (OTE) directly to the component's Chief of Staff or designated representative. OTAs are mandated under U.S. Code Title 10 to ensure that each acquisition system undergoes OT&E before full production and fielding.

Operational test data Data collected from an operational test of a model or system that is used to evaluate the model or system

Operational Test and Evaluation (OT&E) The full range of activities conducted by an OTA in order to fulfill its purpose under US Code Title 10. Determine whether systems are operationally effective and suitable for the intended use by representative users before production or development.

Operational Test Readiness Review (OTRR) An In-Process Review (IPR) conducted by an OTA to determine that a system is sufficiently ready to undergo an operational testing event with favorable results, and that the OTA is adequately prepared to obtain the data needed for evaluation from the operational testing event. The objectives of an OTRR are to prevent the waste of resources through premature operational testing, and to reduce the risk of a noteworthy failure in the execution of a developer's acquisition strategy, which may lead to unanticipated delays in fielding the system or the system's cancellation.

Operator input Data provided to a simulation, model or federation of models by the system operator.

Portability The ability of a simulation to be conducted / operated at alternate sites.

Precision engagement A term used in JV2010 that refers to a system of systems that enables US forces to locate targets, provide responsive C^3, generate desired effects, assess level of success, and retain flexibility to reengage with precision when required.

Problem domain The construct of JWARS that contains five battle space entities (BSEs): Land, Air and Space, Maritime, Mobility, and C4ISR.

Platform domain The construct of JWARS that contains components of the simulation that enable the user to prepare the simulation for use in a study, add and check input data, interact with the simulation during execution, and analyze results.

Regression testing Tests conducted at each development release (or iteration) that retest previously tested areas.

Reliability For the JWARS Program, reliability is defined as the ability of JWARS to perform a simulation under stated conditions for a specified period of time.

Repeatability For the JWARS Program, repeatability is the ability of JWARS to reproduce results of a single deterministic run, or one replication of a stochastic run given the same initial random number seed.

Resolution The process or capability of reducing an object, a model, or a military operation to a simpler form; making distinguishable the individual parts of an object, model, or military operation.

Response time In analysis terms, response time is the time it takes for an analyst to make a run of a given model, review the results, and make an intelligent statement on the findings of the run.

Run control Refers to the amount of control a user of a model or simulation has over the specific characteristics of a given run at the start of the run.

Run time Run time is the time required to complete a single simulation run (in the deterministic mode) or a single replication (in the stochastic mode).

Scratch file File space used during model runs for temporary storage of data.

Security Test Plan (STP) A plan that describes how the security aspects associated with JWARS will be tested.

Strategic mobility The ability to move forces, equipment, and supplies by air or sea transport from one military theater to another (i.e., inter-theater movements).

Suitability (or operational suitability) The degree to which a system can be placed satisfactorily in field use, considering availability, compatibility, transportability, interoperability, reliability, wartime usage rates, maintainability, safety, human factors, manpower supportability, logistics supportability, natural environmental effects and impacts, documentation, and training requirements.

SUMMITS *Scenario Unrestricted Mobility Model for Intra-theater Simulation*. This simulation used mainly by the Joint Staff and OSD (PA&E).

Survivability (or operational survivability) the issue of whether or not the system undergoing test and evaluation is secure, protected, and capable of continuing operations as required despite human and environmental threats.

System Evaluation Plan (SEP) A document that describes the evaluation strategy and overall test effort for the entire acquisition cycle through fielding.

System integrity System integrity means protecting the hardware system, software code, and data integrity from alteration or comprise.

Tactical mobility The ability to move forces, equipment, and supplies by land, air, or sea transport from one location in a theater to another location (i.e., intra-theater movements).

TACWAR *TACTICAL WARFARE* model. A theater level campaign model used mainly by the Joint Staff, the CINCs, and OSD (PA&E).

Tailorability The ability to modify, through data values, the assessment features of a model in terms of scope, fidelity, and resolution.

Task Partitioning Plan Assigns test responsibilities to test organizations by functional area.

Test event plan Describes the environment and activities associated with each test.

Theater of operations The geographical location of the military conflict.

Thread A software development unit that contains the logical functionality needed to represent entities, behaviors, and interactions, and are tailored to support MOE, MOP, and EEA analysis. Threads will be written to represent balanced warfare functionality for modeling purposes. Threads are work packages representing a functional partition of the problem space.

Thunder A theater level campaign model used mainly by the U.S. Air Force.

Traceability The ability to identify why a certain result was obtained from JWARS. It will facilitate identification of cause-and-effect relationships needed to explain analysis.

Unit test A term that refers to informal tests that programmers conduct for testing low-level code.

Usability The hardware, software, and user-interface designs of a model or simulation that makes it easy for a user to use.

Use case test This test concerns the Human-Computer Interface (HCI) design of a model or simulation. It is a test of the sequence of operations used by an analyst when executing JWARS for an analysis. Use case tests are tests designed to prove that the actions performed by the user do occur and will cause specific changes correctly.

User input Data provided by the system user that is specific to that user's interest

Utility The quality or state of being useful

Validation The process of determining the degree to which a model is an accurate representation of the real world from the perspective of the intended uses of the model.

Verification The process of determining that a model implementation accurately represents the developer's conceptual description and specifications.

Verification and Validation agent The person or group that has the responsibility for conducting or overseeing the verification and validation (V&V) of a model or simulation.

Virus A series of computer commands that have been inserted into a operating computer code that will cause a malfunction of the computer code's normal operation.

Verification and Validation (of data) Data verification is the use of techniques and procedures to ensure that data meets constraints defined by data standards and business rules derived from process

and data modeling. Data validation is the documented assessment of data by subject matter experts and its comparison to known values.

ANNEX H
DISTRIBUTION LIST

Distribution of this Test and Evaluation Plan to all Points of Contact identified in Annex C will be made via the JWARS WIPT Web Page. The JWARS Office will distribute copies of the TEP to the JAMIP Steering Committee members. The OST will distribute a copy to the DUSA (OR).